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MONTEREY, CALIFORNIA

THESIS

**LEVERAGING GAMIFICATION TECHNIQUES AND
STRATEGIES AS A MEANS OF IMPROVING
MARITIME BORDER SECURITY DATA COLLECTION**

by

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September 2017

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COLLECTION**

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ABSTRACT

Gamification has served as an emerging trend toward engagement and data collection. This thesis seeks to apply the methods and procedures of gamification systems toward the data gathering processes utilized by U.S. Customs and Border Protection (CBP) as part of its maritime border security strategy. It focuses on what makes gamification work, as well as how it can be applied in the e-government sphere toward improving the interaction between the trade and shipping communities with CBP. A review of existing CBP data collection systems and requirements, as well as a study of the organizational strategies, psychologies, and application techniques, point to the feasibility of gamification features toward solutions to concerns regarding motivation, accuracy, and efficiency of persons providing cargo and supply-chain data to CBP. It recommends the implementation of these features into existing CBP maritime data collection programs used by trade entities.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABI	Automated Broker Interface
ACE	Automated Commercial Environment
ATS	Automated Targeting System
C-TPAT	Customs-Trade Partnership Against Terrorism
CBP	Customs and Border Protection
ISF	Importer Security Filing
SAIP	Population Alert and Information System (French Acronym)

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EXECUTIVE SUMMARY

Gamification concentrates on the application of game elements to non-gaming contexts and has served as an emerging trend toward engagement and data collection. This thesis seeks to apply the methods and procedures of gamification systems toward the data gathering processes utilized by U.S. Customs and Border Protection (CBP) as part of its maritime border security strategy. It focuses on what makes gamification work, as well as how the ideas and methods of gamification can be applied in the e-government sphere toward improving the interaction between global shipping communities and CBP.

The research contained within focuses attention on improving data collection for the Importer Security Filing (ISF) program, a core data collection system for containerized maritime cargo within CBP's layered enforcement strategy. The ISF program includes requirements for the trade community to provide advance data regarding cargo in transit so that CBP systems and personnel may review the information prior to its arrival to destinations within the United States. These reviews are in turn used to identify freight that may represent a risk and to inform the application of CBP resources toward physical cargo examination efforts. Despite financial penalties associated with non-compliance, some shippers still do not provide the necessary information. Internal policies of CBP related to how the agency responds to parties that fail to provide required ISF information do not create significant incentive to follow guidelines. Rather, the tendency to issue penalties only to repeat violators of reporting requirements, those who fail to use "reasonable care," or parties "significantly late" in the filing of ISF information, may reduce the perception of urgency and the incentive for timely participation. This thesis aims to evaluate an alternate method that may serve as motivation to data transcribers within the trade community to provide the required information, as improved participation in the ISF program among trade personnel will increase the effectiveness of CBP's border security strategies.

This thesis reviews the concepts and ideas of gamification. It looks at research associated with the psychological elements in use and evaluates how people think. Among research reviewed are the work of Csikszentmihalyi on flow state and Deci and

Ryan on human motivation. Their writings serve as the foundational research regarding the efficacy of gamification and the rules that make it function.

The thesis also reviews the theory of co-production, the use of activities by both public service agencies and private citizens toward the development or improvement of government enterprises, and evaluates the applications of gamification elements toward enhancing the e-government sphere. It seeks to apply the principles of such theories to the efforts of the Department of Homeland Security (DHS) and looks to existing gamified public safety and security programs as examples of how to make gamification work for the ISF program.

Evaluations are conducted of existing applications of gamification methods employed within global security arenas. Methods to enhance the e-government space and engage the public to provide data beneficial toward government operations, specifically those related to public safety and security, have been employed with some success in locations such as Australia and France. Gamification efforts have also been used with much success in private-sector environments. websites, such as LinkedIn and Facebook, as well as apps and programs, such as Microsoft's Ribbon Hero and Nike's Nike+, have shown the effectiveness of utilizing gamified features to create action among a target audience. The use of gamification within the context of ISF aims to increase trade community participation via DHS web-based systems by inviting the active participation of citizens in the delivery of services in a similar manner. The success of this endeavor is dependent on the active participation of citizens and private-sector interests in these platforms, further incentivized through the inclusion of motivational factors.

The review of existing CBP data collection systems and requirements, as well as a study of the organizational strategies, psychologies, and application techniques, point to the feasibility of gamification features toward solutions to concerns regarding motivation, accuracy, and efficiency of persons providing cargo and supply-chain data to CBP. By encouraging trade entities to provide more detailed and potentially more complete information about the transit of containers, the intention and risk of the cargo, and of involved parties, the incorporation of game elements in ISF data systems may improve the ISF program's performance. The thesis recommends the implementation of these

features into existing CBP maritime data collection programs used by trade entities. It advocates for the application of gamification principles to existing CBP systems utilized by low-volume importers as part of a pilot program to evaluate overall effectiveness of the methods. Unlike larger companies, small-scale importers are more likely to use CBP systems, rather than proprietary technology, to transmit cargo data to the DHS. Since this group is more likely to utilize a CBP-owned system, it also represents the easiest group to impact with a gamified system. Thus, the simplest solution toward employing gamification is to create changes that impact this smaller contingent. In doing so, CBP not only creates a system that works toward enhancing maritime border security, but also creates a template for future growth and enhancement of methods.

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I. THE LANDSCAPE

A. RESEARCH QUESTION

Can gamification be effectively utilized toward the improvement of Customs and Border Protection (CBP) data collection?

The thesis explores the methods to improve the interaction of the trade community, particularly importers, with the Department of Homeland Security's (DHS) main border security agency in effort to create a more engaging electronic environment for the benefit of both the community and CBP.

B. PROBLEM SUMMARY

CBP officers within the homeland security enterprise protect national security by “detecting high-risk activity, deterring non-compliance, and disrupting fraudulent behavior.”¹ To accomplish this goal, the agency relies on information provided by trade industry stakeholders. CBP uses the information provided by the trade entities to improve container inspection and targeting practices, and to conduct reviews necessary to “ensure a fair and competitive trade environment.”² However, despite legislated reporting requirements and significant monetary penalties for some cases of trade non-compliance, reporting and compliance rates from trade entities still leave room for improvement.³

To increase compliance rates, CBP needs to evolve the methods used for data collection. Existing data collection systems are difficult to use and do not motivate users toward data entry. CBP needs to enhance the electronic government (e-government) workspace. Therefore, this thesis focuses on the utilization of gamification as a user

¹ Gil Kerlikowske, “Commissioner Kerlikowske’s Remarks at the Joint Annual Meeting of the American Iron and Steel Institute (AISI) and the Metals Service Center Institute (MSCI),” May 2, 2016, <https://www.cbp.gov/newsroom/speeches-and-statements/2016-05-02-000000/commissioner-kerlikowske’s-remarks-joint-annual>.

² “Trade,” accessed May 29, 2016, <https://www.cbp.gov/trade>.

³ U.S. Customs and Border Protection, *Importer Security Filing (ISF) Enforcement Update Webinar—Transcript* (Washington, DC: Department of Homeland Security, 2016), https://www.cbp.gov/sites/default/files/documents/ISF%20Webinar_Transcript_0.pdf.

engagement method toward improving coordination between the border security agency and private industry.

Gamification is the use of game design elements for the purpose of non-game contexts, especially for the benefit of improving user engagement and user effectiveness toward overall value creation.⁴ Gamification activities have been credited with increasing social interaction, creating productivity, and improving the quality of information or action through the activity of users.⁵ These results are considered to take effect due to the propensity of implemented game methods to bring about intrinsically motivating experiences and positive patterns in users.⁶

A large number of companies provide gamification services and an increasing number are making investments into gamification efforts; however, understanding whether gamification is effective is a question still being asked by academia.⁷ Gamification has emerged as a topic of heavy discussion, for example, in the technology industry, largely based on anecdotal and intuitive assumptions, which are largely focused on positive perceptions.⁸ However, comprehensive analysis of gamification theory and possible applications to homeland security do not appear to have been effectively evaluated.

C. RESEARCH DESIGN

This thesis establishes the problem set by analyzing existing CBP policies designed to generate a response and information sharing with the trade environment for

⁴ Sebastian Deterding et al., “Gamification: Toward a Definition,” paper presented at the CHI 2011 Gamification Workshop Proceedings, Vancouver, BC: Canada, May 7–12, 2011, <http://gamification-research.org/wp-content/uploads/2011/04/02-Deterding-Khaled-Nacke-Dixon.pdf>.

⁵ Juho Hamari, “Transforming Homo Economicus into Homo Ludens: A Field Experiment on Gamification in a Utilitarian Peer-to-Peer Trading Service,” *Electronic Commerce Research and Applications* 12, no. 4 (2013): 236–245.

⁶ Richard M. Ryan and Edward L. Deci, “Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-being,” *American Psychologist* 55, no. 1 (2000): 68–78.

⁷ Juho Hamari, Jonna Koivisto, and Harri Sarsa, “Does Gamification Work? A Literature Review of Empirical Studies on Gamification,” paper presented at the 47th Hawaii International Conference on System Sciences, January 6–9, 2014.

⁸ Ibid.

use in CBP targeting protocols, as well as the origins of the Importer Security Filing program, to include its goals and success rates. It further explores the characteristics of the program and analyzes its strengths and weaknesses by evaluating the program implementation toward the DHS's mission focus. As any issues associated with noncompliance create an environment whereby exploitation can occur, or conversely, can negate the purposes of established programs by increasing CBP physical inspection rates, the problem set should be sufficiently established.

After identifying the problem set, the thesis addresses the central question: "*Can gamification techniques and strategies be leveraged in order to improve CBP's data collection processes, specifically those related to the Importer Security Filing program?*" The thesis then describes and reviews existing public and private sector methodologies for user engagement, specifically gamification as a motivating and interest generating method. It also reviews psychological factors at play, development requirements, and applicability to existing CBP developed systems. After discussing the potential value of these approaches, the thesis discusses potential methods of implementation toward CBP goals.

The intended output of this thesis is the detailed identification of existing problem sets in the border security environment, the proposal of a solution to mitigate the issue, and the evaluation of the potential impact of the proposed solution. After presenting the policy options of the new, gamified, approaches to data collection, the thesis promotes a methodology for implementation. This thesis does not specify preferred designs, or the operation and management processes of the gamified systems. Rather, it focuses on identifying the viability of gamification as a method that may be employed. To enact gamification within CBP systems, additional steps are required.

D. THEORETICAL SENSITIVITY

As the researcher of this thesis, I have been fortunate enough to have been involved professionally with the implementation and applications of government programs discussed as part of this document. These actions include those I have seen and heard as part of my professional development and work experiences, which are not

referenced explicitly within the text, but which drive my efforts. This experience establishes a need for research related to the alternative methods of data collection explored throughout.

II. COUNTERING THE THREAT—THE PROBLEM SPACE

A. INTRODUCTION

No one involved with the container's development imagined that metal boxes would come to be regarded as a major security threat. Improved security, ironically, was originally one of the container's big selling points.

~ Marc Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*

The maritime environment is critical to the success of international trade and to the receipt of commodities that might be purchased within the United States. A 2013 Stimson Center report notes “even in the midst of a global economic slowdown, at any given moment, there are some 20 million intermodal freight transport containers moving around the globe. More than 4,600 ships carry many of those containers on over 200 million trips per year.”⁹ Innovative transportation technologies can be credited with the accelerated movement of goods seen throughout the globe.¹⁰ Containerization, larger and more efficient ships, roll-on/roll-off cargo container vessels, new loading and unloading tools, and improved logistics techniques have all contributed to the continued growth of the maritime shipping industry.¹¹

A modern container port is a significant place of work. At each berth sits a large oceangoing vessel. Vessels may be up to 1,300 feet long and 170 feet across, and these same machines can be loaded with as many as 18,000 metal shipping containers.¹² Standing along the docks, a row of enormous cranes loads and unloads the cargo at rapid

⁹ Nate Olson, Brian Finlay, and Esha Mufti, *A Go-to-Market Strategy: Promoting Private Sector Solutions to the Threat of Proliferation* (Washington, DC: Henry L. Stimson Center, 2013).

¹⁰ Ibid.

¹¹ Ibid.

¹² Martin Cox, “CMA CGM BENJAMIN FRANKLIN Gets Hollywood Welcome,” *Maritime Matters*, December 27, 2015, <http://maritimematters.com/2015/12/cma-cgm-benjamin-franklin-gets-hollywood-welcome/>.

pace. Containers are lowered onto transporters and moved to storage yards where they await release from cargo terminals, either by truck, or train. The process is repeated about every two minutes, each crane moving as many as 40 containers an hour from a ship.¹³ Roughly 325 seaports transfer more than 25,000 containers on any given day.¹⁴

Researchers focused on the subject of supply chain risk management acknowledge that managing risks in this logistically complicated environment poses a significant challenge.¹⁵ This challenge results due to greater uncertainties in the globalization of markets, and the increased use of outsourced manufacturing and delivery resulting in multi-faceted international supply chains, which lead to an ever increasing exposure to risks.¹⁶

B. POSSIBILITY OF TERRORISM AND THE RISKS OF SMUGGLING

Ships, and the infrastructure that they utilize, in addition to the people and companies that operate these items, along with the assortment of brokers, freight forwarders, carriers, and other professionals who manage the transit of cargo, all represent mission critical components of the global transportation network. This network of moving containers contributes significantly to the way of life that Americans currently have.¹⁷ Unfortunately, potential effects on the American quality of life and impacts to American financial interests are among the major criteria terrorists are known to apply when selecting their targets, making the supply chain associated with maritime freight an

¹³ Marc Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger* (Princeton, NJ: Princeton University Press, 2006), 4.

¹⁴ Luke Ritter, J. Michael Barrett, and Rosalyn A. Wilson, *Securing Global Transportation Networks: A Total Security Management Approach* (New York: McGraw-Hill, 2007), 132.

¹⁵ Shashank Rao and Thomas J. Goldsby, "Supply Chain Risks: A Review and Typology," *The International Journal of Logistics Management* 20, no. 1 (2009): 97–123.

¹⁶ Ibid.

¹⁷ In 2010, Maritime transportation contributed \$36 billion U.S. dollars and 64,000 jobs to the U.S. economy. By value, vessels carry 53% of U.S. imports and 38% of exports, representing the greatest share of any transportation mode. "Maritime Trade and Transportation by the Numbers," United States Department of Transportation, Bureau of Transportation Statistics, accessed August 4, 2017, https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/by_the_numbers/maritime_trade_and_transportation/index.html

attractive target.¹⁸ Concern has arisen that within the multitude of moving parts lay security gaps that may leave the United States vulnerable to a significant disruptive event. Estimates differ regarding the total financial impacts of an attack on cargo flow; however, research on the subject specific to individual ports provides perspective on the economic effects of such an attack, as shown in Table 1.

Table 1. Costs of Various Terrorist Attacks

Author	Concern	Cost Estimate
Rosoff and Winterfeldt ¹⁹	Dirty Bomb in Los Angeles/Long Beach Seaports	Between \$130 million and \$100 billion, dependent on length of shutdown. (Assumes zero lives lost.)
Meade and Molander ²⁰	10-kiloton nuclear bomb at Port of Long Beach, CA	\$1 trillion
Gordon et al. ²¹	Los Angeles/Long Beach Seaports	Between \$1.1 billion and \$34 billion
Park ²²	Dirty Bomb in Los Angeles/Long Beach Seaports	Approximately \$34 billion in import/export losses. (No estimate of value of property or lives lost)
Jung et al. ²³	Forced Shutdown (10-days) of Los Angeles/Long Beach Seaports	Between \$770 million and \$1.3 billion per day

¹⁸ Maarten van de Voort et al., “Applying Risk Assessment to Secure the Containerized Supply Chain,” in *Managing Critical Infrastructure Risks*, ed. Igor Linkov, Richard J. Wenning, and Gregory A. Kiker (Netherlands: Springer, 2007), 79–95.

¹⁹ Heather Rosoff and Detlof Von Winterfeldt, “A Risk and Economic Analysis of Dirty Bomb Attacks on the Ports of Los Angeles and Long Beach,” *Risk Analysis* 27, no. 3 (2007): 533–546.

²⁰ Charles Meade and Roger C. Molander, *Considering the Effects of a Catastrophic Terrorist Attack* (Santa Monica, CA: RAND, 2006), http://www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR391.pdf.

²¹ Peter Gordon et al., “Ch. 14. The Economic Impact of a Terrorist Attack on the Twin Ports of Los Angeles-Long Beach,” in *The Economic Impacts of Terrorist Attacks*, ed. Harry W. Richardson, Peter Gordon, and James E. Moore II (Cheltenham, United Kingdom: Edward Elgar Publishing Ltd., 2007), 262.

²² JiYoung Park, “The Economic Impacts of Dirty Bomb Attacks on the Los Angeles and Long Beach Ports: Applying the Supply-driven NIEMO (National Interstate Economic Model),” *Journal of Homeland Security and Emergency Management* 5, no. 1 (2008).

²³ Jeessang Jung, Joost R. Santos, and Yacov Y. Haimes, “International Trade Inoperability Input-Output Model (IT-IIM): Theory and Application,” *Risk Analysis* 29, no. 1 (2009): 137–154.

The potential for a cargo container to be used for the movement of equipment for the benefit of terrorist action have made the security of containerized freight, more specifically maritime cargo, an imperative. The transportation of goods via containerization is both economical and efficient; however, it is also at risk of misuse. Terrorist groups, such as Al-Qaeda, have increasingly been known to use shipping containers to move agents and probable terrorist-related material around the globe.²⁴

A 2005 report points to two key scenarios that should be prevented:

A container could be used as a weapon to attack a port or any other facility along a transport chain after unloading from a ship or even while still on the ship before inspection. Many ports are located in major population and industrial centers and contain significant quantities of oil and other vital commodities. Such attacks could be conducted using WMD or large quantities of conventional explosives. Attacks could also be launched on a vulnerable target from a container on a truck, train, or barge.

Containers could be used to transport complete WMD or WMD components to terrorists, who could then use them at a time and place of their choosing.²⁵

A catastrophic event within the maritime transportation system could affect international supply chains, which would impact regional communities, individual companies and the global economy.²⁶ Such an event would also hinder domestic production, impact consumer confidence, and could have severe social and political effects.²⁷ Maritime commerce is of great importance and an inefficient or damaged shipping system will restrict trade necessary for the success of U.S. and global economies.²⁸ Additionally, as the maritime cargo industry for legitimate goods has

²⁴ Michael Richardson, "Growing Vulnerability of Seaports from Terror Attacks," YaleGlobal Online, March 4, 2014, <http://yaleglobal.yale.edu/content/growing-vulnerability-seaports-terror-attacks>.

²⁵ Ola Dahlman et al., *Container Security: A Proposal for a Comprehensive Code of Conduct* (Washington, DC: National Defense University, Center for Technology and National Security Policy, 2005).

²⁶ Timothy J. Leonard, Philip Gallo, and Simon Véronneau, "Security Challenges in United States Sea Ports: An Overview," *Journal of Transportation Security* 8, no. 1–2 (2015): 43, <https://nps.illiad.oclc.org/illiad/illiad.dll?Action=10&Form=75&Value=150548>.

²⁷ Ibid.; Dahlman et al., *Container Security: A Proposal for a Comprehensive Code of Conduct*, 5.

²⁸ Leonard, Gallo, and Véronneau, "Security Challenges in United States Sea Ports: An Overview," 43.

developed, so too has the movement of illegitimate items, such as counterfeit products, drugs, small arms, and quite possibly, weapons-useable materials and technology. The Stimson Center in Washington, DC noted that “if there is a common sector that touches upon virtually every flow of contraband—be it WMD proliferation, narcotics, counterfeit intellectual property, or small arms and light weapons—it is the legitimate shipping industry.”²⁹

A terrorist attack on a U.S. seaport could cause local devastation and significantly impact the global economy.³⁰ Still, just as much a threat, the containers being transported via maritime transportation methods could be utilized as a means of smuggling weapons or parts thereof into the United States.

While the high-efficiency cargo transportation mechanisms have become a blessing for importers, they have become a hindrance for customs inspectors and security officials. With the growth of the shipping and global logistics industries, CBP, the main border security agency for the United States, has found it challenging to screen incoming cargo effectively.³¹ Although a manifest listing the contents of each container is presented, neither shipping lines nor ports can be certain that the manifest corresponds to what is truly inside. Containers are also difficult to check by hand. Levinson notes “With a single ship able to disgorge 3,000 40-foot-long containers in a matter of hours, and with a port such as Long Beach... handling perhaps 10,000 loaded containers on the average workday...not even the most careful examiners have a remote prospect of inspecting them all.”³² A standard shipping container is 20 to 45 feet long and often fully packed, making inspections challenging. Opening the door of a container normally reveals a wall

²⁹ Olson, Finlay, and Mufti, *A Go-to-Market Strategy: Promoting Private Sector Solutions to the Threat of Proliferation*, 13.

³⁰ Jonathon P. Vesky, ed., *Port and Maritime Security* (Hauppauge, NY: Nova Publishers, 2008).

³¹ Stephen L. Caldwell, *Supply Chain Security—Container Security Programs Have Matured, but Uncertainty Persists over the Future of 100 Percent Scanning* (GAO-12-422T) (Washington, DC: United States Government Printing Office, 2012).

³² Caldwell, *Supply Chain Security—Container Security Programs Have Matured, but Uncertainty Persists over the Future of 100 Percent Scanning*; Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*, 7.

of cardboard boxes.³³ The labor requirements involved in unloading a container dockside, inspecting the individual boxes, and reloading the freight would bring the entire cargo transportation system to a crawl.³⁴

C. CBP PREVENTATIVE SYSTEMS

Protecting goods while in passage requires cargo tracking and monitoring to uphold visibility and the chain of custody, ensuring that the persons maintaining the cargo are trustworthy and have proper credentials, and safeguarding the physical security of the container loading and unloading facilities.³⁵ In addition, it is critical to be able to certify the security of the other parties in the supply chain process, to include the carriers who move the freight, the transfer facilities, the documentation professionals who handle the paperwork, and the second and third tier suppliers. An evaluation of the various elements at play requires a wide-reaching approach, involving enhanced tools, better information, and the participation and cooperation of maritime and trade stakeholders. Efficient cargo screening requires CBP to employ a layered enforcement strategy, which includes trusted traders programs, inspection at foreign ports, and the mandatory advance reporting of containerized sea cargo.

In *Securing Global Transportation Networks*, authors point to baseline methods to enhance cargo security, “Establishing control at the point of origin of each component significantly reduces the risk of a security breach and cuts down on the total cost of a move. In general, more awareness regarding the movement of assets in transit equates to enhanced security and customer satisfaction.”³⁶ CBP has become reliant on information provided from shippers and vessel operators to ensure that the commodity is compliant with United States laws and is free of risk. Prior to 2009, much of this data would have been received during the entry process, with the paper filing of documents relating to the

³³ Ibid.

³⁴ Jon D. Haveman and Howard J. Shatz, *Protecting the Nation's Seaports: Balancing Security and Cost* (San Francisco: Public Policy Institute of California, 2006), 108, http://www.ppic.org/content/pubs/report/R_606JHR.pdf.

³⁵ Ritter, Barrett, and Wilson, *Securing Global Transportation Networks: A Total Security Management Approach*, 132.

³⁶ Ibid., 133.

shipment. However, the entry process is not a requirement until the conveyance and cargo have physically arrived at a port of entry. If a shipper were to attempt to bring something illicit into this country, the item may already be on U.S. soil before having any chance of being discovered using this mechanism.

1. Introduction to ISF

To combat this risk, CBP enacted the Importer Security Filing (ISF) and Additional Carrier Requirements program in January 2009 to gather advance data on cargo prior to its arrival into the United States.³⁷ Also known as the “10+2” program, this system exists to acquire data about cargo prior to its arrival. This data is then able to be reviewed while the vessel is in transit to the United States to identify a potential threat before its cargo lands on U.S. soil. This program is made up of 10 key data points collected from importers, and two data points collected from vessel carriers used for risk evaluation purposes. Many of CBP’s protocols for cargo security are connected in some way with the data collected through this program.

The initiative derives its legal basis from Section 203 of the *Security and Accountability for Every Port Act of 2006* and an interim final rule published by CBP on November 25, 2008. Widely known as the “SAFE Port Act,” this document requires the Secretary of Homeland Security to propagate regulations that “require the electronic transmission to the Department [of Homeland Security] of additional data elements for improved high-risk targeting, including appropriate security elements of entry data...”³⁸ Information related to cargo destined for the United States is stated to be required “prior to loading of such cargo on vessels at foreign seaports.”³⁹ CBP announced that the

³⁷ “Importer Security Filing ‘10+2’,” July 5, 2017, <https://www.cbp.gov/border-security/ports-entry/cargo-security/importer-security-filing-102>.

³⁸ National Archives and Records Administration, *Part II, Department of Homeland Security, U.S. Customs and Border Protection, 19 CFR Parts 4, 12, 18, et al. Importer Security Filing and Additional Carrier Requirements; Final Rule, Federal Register*, vol. 73, no. 228 (College Park, MD: National Archives and Record Administration, 2008), <https://www.gpo.gov/fdsys/pkg/FR-2008-11-25/pdf/E8-27048.pdf>.

³⁹ Ibid.

implementation of the ISF requirements would largely go into effect on January 26, 2009, with full implementation scheduled for early 2010.⁴⁰

The ISF Rule requires importers to transmit data elements associated with their shipments to CBP. Minor allowances are given for the filing of two of the 10 data elements. Per the Federal Register, the 10 required data elements are as follows:

Data required 24 hours prior to lading:

- Importer of Record Number
- Consignee Number
- Seller
- Buyer
- Ship to Party (recipient)
- Name and Address of the Manufacturer or Supplier
- Country of Origin
- Harmonized Tariff Schedule number for commodity

Data required as soon as possible, but no later than 24 hours prior to arrival:

- Container Stuffing Location
- Name and Address of Cargo Consolidator (Stuffer)⁴¹

Under the ISF program, most of the data is meant to be received prior to departure from the foreign port. Without advance data on what is actually coming, the targeting and selection protocols used by CBP are ineffective. Largely due to the logistics and cost involved with the loading and unloading of containers onto vessels, if no data is received for a particular container, the cargo is still permitted to depart the foreign port; however, the data must be received before a container is granted entry into the United States

⁴⁰ Bryce C. Blegen, "U.S. Importer Security Filing: Advance Electronic Data under the SAFE Framework Meets the Real World," *World Customs Journal* 3, no. 1 (2009): 71–83.

⁴¹ National Archives and Records Administration, *Part II, Department of Homeland Security, U.S. Customs and Border Protection, 19 CFR Parts 4, 12, 18, et al. Importer Security Filing and Additional Carrier Requirements; Final Rule, Federal Register*, vol. 73, no. 228, 71731.

following its arrival.⁴² Thus, the heart of the problem lies here. If a container is loaded onto a vessel and does not submit ISF documentation, this cargo is still permitted to make landfall, and while not permitted to exit the terminal or port, may represent the same level of risk as if the ISF program never existed.

Legitimate reasons exist as to why the trade may not be able to provide all the required data. For example, the cargo within the container may still be seeking a U.S. buyer while it is in transit, and therefore, information associated with the cargo recipient will not be available. In such cases, the importer is required to provide the information as soon as it is available. The importer is also responsible for tracking which containers or shipments have not submitted sufficient documentation. For companies that import significant amounts of cargo, this task can be burdensome, and sometimes, available information is not provided.⁴³

Not filing ISF documentation can be costly. Financial penalties are assessed on either the carrier or importer, whichever failed to file the information as required. If a filing is inaccurate, incomplete, or made in an untimely manner, CBP can assess liquidated damages. Damages or penalties may be assessed as follows: \$5,000.00 per late ISF, \$5,000.00 per inaccurate ISF, and \$5,000.00 for the first inaccurate ISF update or amendment.⁴⁴ If cargo for which no ISF information has been filed arrives at a U.S. port, CBP is permitted to deny the release or withhold the transfer of goods to its owner.⁴⁵ Additionally, because the cargo is not released until the data is acquired, terminal operators and ports assess storage and drayage fees for any cargo held at U.S. shipping terminals. However, the problem still persists. Penalties and associated storage costs have not brought the trade community into compliance with the laws, as they are designed to do.

⁴² U.S. Customs and Border Protection, *Importer Security Filing (ISF) Enforcement Update Webinar—Transcript*.

⁴³ Ibid.

⁴⁴ “CBP Enters Next Phase of Importer Security Filing,” June 7, 2013, <https://www.cbp.gov/newsroom/national-media-release/cbp-enters-next-phase-importer-security-filing>.

⁴⁵ Ryan Petersen, “Customs Compliance: Importer Security Filing,” Flexport, 2014, <https://www.flexport.com/learn/customs-compliance-importer-security-filing/>.

Despite the defined requirements and associated costs derived from the failure to comply with the requirements of the ISF program, the non-compliance rate still falls at approximately eight percent.⁴⁶ While that percentage may appear to be a low failure rate, it actually signifies a substantial concern. The U.S. processes approximately 11 million maritime containers annually, with some estimates as high as 14.5 million, since every non-participating shipment represents a risk requiring physical examination. , there are on average approximately 880K to 1.1M containers which need to be manually inspected by CBP officers.⁴⁷ Additionally, because of the volume of non-ISF-compliant containers entering U.S. ports, CBP has had difficulty tracking and serving penalties as is permitted by law. As a result, CBP was forced to pare down its penalty process to make the workload more manageable. CBP policy mandates that only “significantly late violations” and “repeat offenders” may receive a penalty.⁴⁸ As described in the guidance, the definition of “significantly late” is described as “purposefully nebulous in its definition.”⁴⁹

2. How ISF is Filed

ISF filings submitted by importers are generally provided to CBP electronically through the Automated Broker Interface (ABI) and are unable to be provided in paper format. In most cases, importers file ISFs through their customs brokers; however, importers who participate in the Automated Commercial Environment (ACE) program may file ISF information directly.⁵⁰ Some filers self-program their own software to accomplish this task, but often the broker or importer purchases software from private

⁴⁶ U.S. Customs and Border Protection, *Importer Security Filing (ISF) Enforcement Update Webinar—Transcript*.

⁴⁷ U.S. Customs and Border Protection, *Container Security Initiative in Summary* (Washington, DC: Department of Homeland Security, 2011), https://www.cbp.gov/sites/default/files/documents/csi_brochure_2011_3.pdf; Angela Greiling Keane and Kyunghhee Park, “The Terrorist Threat in Cargo Containers,” *Bloomberg BusinessWeek*, November 4, 2010, <https://www.bloomberg.com/news/articles/2010-11-04/the-terrorist-threat-in-cargo-containers>.

⁴⁸ U.S. Customs and Border Protection, *Importer Security Filing (ISF) Enforcement Update Webinar—Transcript*.

⁴⁹ *Ibid*.

⁵⁰ Petersen, “Customs Compliance: Importer Security Filing.”

vendors meant to complete data packages. Smaller scale importers who file infrequently are permitted to file up to 12 ISFs annually through a CBP owned and managed system known as ISF Portal.⁵¹

The data elements are then sent to CBP's Automated Targeting System (ATS). This data is in turn used by the ATS to assign each container a score based on risk related to weapons of mass effect, drugs or related contraband, or the chances of commercial fraud.⁵² In conjunction with this system, CBP officers compare cargo and conveyance information (again, largely derived from 10+2 data) against intelligence and law enforcement databases to determine whether a given container will require physical inspection.⁵³

D. CURRENT EFFORTS JUST ARE NOT ENOUGH

Existing penalty procedures are ineffective in generating participation levels necessary toward fulfilling the security goals that the ISF program was designed for, and current data collection systems have been reported to be unwieldy by users. How then might CBP bring the trade community into compliance? To improve compliance rates, CBP needs to evolve the methods used for data collection. Existing data collection systems are difficult to use and do not motivate users toward data entry.

E. CONCLUSION—AN ENHANCED APPROACH

The ISF program is complemented by other border security strategies and systems and represents one piece of a “defense in depth” or “layered enforcement” strategy; the use of multiple methods to detect and interdict a weapon.⁵⁴ This strategy is based on the simple premise that it is harder to evade several methods than one. Attempts by criminals

⁵¹ U.S. Customs and Border Protection, *Benefits of ACE for Importers Fact Sheet* (Washington, DC: Department of Homeland Security, 2012), https://www.cbp.gov/sites/default/files/documents/overview_importers_fact_sheet_2.pdf.

⁵² Vivian C. Jones and Marc R. Rosenblum, *U.S. Customs and Border Protection: Trade Facilitation, Enforcement, and Security* (CRS Report No. R43014) (Washington, DC: Congressional Research Service, 2013).

⁵³ Ibid.

⁵⁴ Vesky, *Port and Maritime Security*, 3.

and potential terrorists to evade detection in one system may make their intentions more visible to another, thereby reducing their effectiveness.

A defense in depth strategy also aims to push the detection and interdiction of illicit materials farther from U.S. shores, and in this regard, the ISF program is achieving its baseline goals. However, reports from CBP officials regarding the participation rate of ISF suggest that these border security efforts have stalled, leaving a gap in the overall border security strategy. Enhancements to the program's data acquisition methods are warranted. Improved participation among the trade community will increase the effectiveness of CBP's border security strategies and will benefit the nation as a whole.

To improve upon the current condition of CBP's advance data collection approaches, it is necessary to explore alternative ways to enhance participation levels by the shipping communities. The current compliance technique of financial penalty has not been sufficient in increasing trade community participation rates, as they were designed to do. Additionally, these efforts do not encourage or leverage relationships with trade community members who may be forthcoming with information beneficial to maritime security in the future. This difficulty is compounded by existing computer systems that complicate the flow of information. The following chapter discusses advances in data collection techniques utilized in private sector environments that suggest that gaming technology and methods are a possible way to increase user participation and serve as a potential enhancement to the existing ISF efforts.

III. LITERATURE REVIEW

If he had been a great and wise philosopher... he would now have comprehended that Work consists of whatever a body is obliged to do, and that Play consists of whatever a body is not obliged to do. And this would help him to understand why constructing artificial flowers or performing on a tread-mill is work, while rolling ten-pins or climbing Mont Blanc is only amusement.

~ Mark Twain, on Tom tricking peers into whitewashing a fence, *The Adventures of Tom Sawyer*

CBP data collection programs rely on gathering information from outside sources, and as such, an understanding of the psychological factors at play for those who provide the data may be used to create an impetus for participation. Several applicable theories are available regarding the motivation derived from the areas of social and educational psychology and organizational science that may be relevant. As a tool for generating user engagement, gamification strategies have become widely utilized in the private-sector environment. While some studies focused on gaming strategies for teaching or advertising are available, research in the study of homeland security vis-à-vis gaming strategies for public engagement are nearly non-existent. This review focuses on employing gaming dynamics to engage and educate private citizens and public agencies toward improving homeland security.

It is possible that game features not only can provide an engaging and enriching educational medium but they may also address the emerging educational needs of modern generations who have become accustomed to more interactive environments. Leveraging games and game strategies may help close current knowledge gaps and increase the nation's resilience.

A. FLOW CHANNEL THEORY

Named by Mihaly Csikszentmihalyi, the concept of flow, or optimal experiences, is at the core of positive psychology. Flow is a mental state where a person becomes fully immersed in what they are doing, feels fully involved, and enjoys the process, resulting in

a feeling of energized focus.⁵⁵ Csikszentmihalyi's research suggests a correlation between the quality and engagement during a flow experience and a person's perceived level of challenge.⁵⁶ The concept is applicable to many different fields and activities as a means of generating engagement and encouraging participation among individuals and groups. Also known as "being in the zone," flow serves as the state of being in a completely focused motivation.

Flow is a single-minded immersion process, one in which a participant is extremely focused on a task. Often people's emotions have been impacted in the service of performing their function. Flow is not just channeled energy or activity; it is energized, positive, and engaged in a task. Csikszentmihalyi characterizes the process as "the holistic sensation that people feel when they act with involvement."⁵⁷ In this sense, flow channel is derived from intrinsically motivating factors that influence the individual. According to Csikszentmihalyi, when a person is able to achieve a state of flow "even the usually boring routines of work become purposeful."⁵⁸ The flow channel is characterized by a focusing of the concentration of an individual, so "irrelevant perceptions and thoughts are filtered out."⁵⁹ This experience is credited as being the main reason for performing the activity.⁶⁰ To engage an individual, as the e-government sphere should be working toward, the reaction of flow experience within the user is a benefit toward the end goal.

Additional research into Flow Channel Theory determined that dependent on the level of challenge and skill, a person's engagement level can be divided into four parts. First, flow involves high challenge and high skill. People do not experience flow when

⁵⁵ Mihaly Csikszentmihalyi, *Flow: The Psychology of Optimal Experience* (New York: Harper Row, 1990).

⁵⁶ Yu-Tzu Chiang et al., "Exploring Online Game Players' Flow Experiences and Positive Affect," *TOJET: The Turkish Online Journal of Educational Technology* 10, no. 1 (January 2011): 106–114.

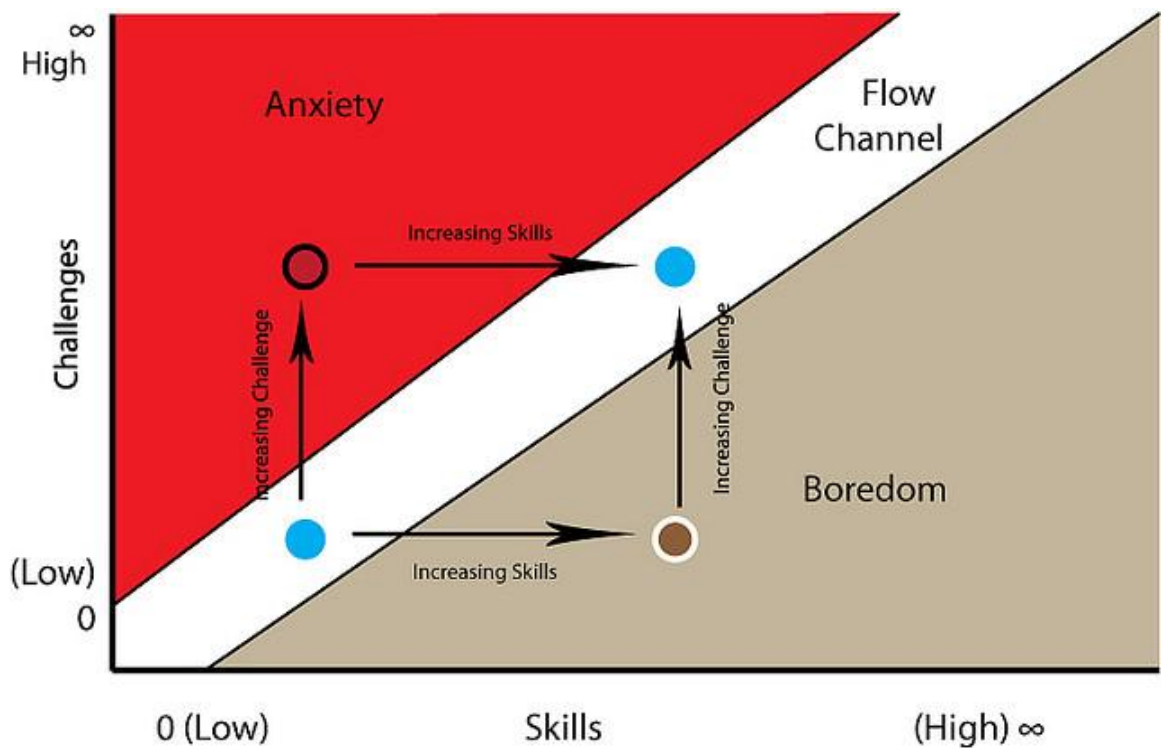
⁵⁷ As cited in Christina Finneran and Ping Zhang, "The Challenges of Studying Flow within a Computer-mediated Environment," *AMCIS 2002 Proceedings* (2002): 146.

⁵⁸ Csikszentmihalyi, *Flow: The Psychology of Optimal Experience*, 40.

⁵⁹ As cited in Thomas Novak and Hoffman, Donna, "Measuring the Flow Experience among Web Users," paper presented at Interval Research Corporation, July 31, 1997, 3.

⁶⁰ Ibid.

they are unchallenged and the task is tedious. Anxiety is characterized by high challenge and low skill involvement. Boredom is achieved when a task involves low challenge and high skill, and apathy occurs when both challenge and skill required are low.⁶¹ Usually people feel best when not under challenged, nor is it best to be over challenged at which point people become frustrated and anxious, but rather, it is ideal to be in the middle area when neither over nor under challenged, and where the challenges match abilities.⁶² Thus, the key to generating flow is in creating an engaging method that is both exciting and skillful (see Figure 1), whereby actually mastering the skills results in a feeling of achievement.



Mihaly Csikszentmihalyi, Flow Channel. Adapted from 1990 Flow: The Psychology of Optimal Experience

Figure 1. The Flow Channel Process

⁶¹ Wen-Lung Shiau, Li-Chun Huang, and Chia-Hui Shih, "Understanding Continuance Intention of Blog Users: A Perspective of Flow and Expectation Confirmation Theory," *Journal of Convergence Information Technology* 6, no. 4 (2011): 308.

⁶² Csikszentmihalyi, *Flow: The Psychology of Optimal Experience*.

As shown in Figure 1, the red area represents anxiety and the tan region represents boredom. Csikszentmihalyi says that individuals are in a state of flow when the level of challenge and the level of skill required are proportional to each other, as depicted in the white diagonal space. It is within this state that people feel the greatest sense of satisfaction and the greatest sense of enjoyment from a given task. Based on his research within this arena, it seems that creating a system or enhancing current systems by providing users with immediate feedback to their actions, enjoyment, the ability to induce high levels of user concentration, or playfulness will enhance the likelihood that a user will reach a state of flow, and thus, of significant participation within the systems.

B. SELF-DETERMINATION THEORY

Self-determination theory describes human motivation and personality in social contexts. It differs from traditionally defined work environments that are autonomous and controlled and concentrates on the amount that an individual's actions are self-motivated and self-determined.⁶³ The theory, initially developed by Edward L. Deci and Richard M. Ryan, is concerned with the types of motivation behind the choices that people make without interference from others, rather than amount of motivation. It accomplishes this analysis by concentrating on autonomous motivation, controlled motivation, and amotivation as predictors of overall performance.⁶⁴

Self-determination focuses on three psychological needs: autonomy, competence, and relatedness.⁶⁵ Autonomy is characterized as the ownership of one's behavior but differs from independence. Instead, it refers to a sense of free will when participating in an activity or acting out of an individual's own interests and values; the freedom to do as a person wishes without significant oversight. Autonomy is high when people feel little to no pressure, while enjoying high freedom. Conversely, it is considered to be low when a

⁶³ Edward L. Deci and Richard M. Ryan, "Self-Determination Theory," *Handbook of Theories of Social Psychology* 1 (2011): 416–433.

⁶⁴ Deci and Ryan, "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being," 68–77.

⁶⁵ *Ibid.*, 68.

person is motivated by a feeling of burden and force themselves into or out of action.⁶⁶ Competence is the ability to generate preferred results and to experience mastery and success. It focuses on the desire to govern and master the environment. Relatedness is a feeling of connectedness with others. Daily activities involve other people, and as a result, a sense of belonging is pursued.⁶⁷ When these three needs are satisfied, intrinsic motivation for a task is generated. Research related to this theory indicates a link between autonomy satisfaction, intrinsic motivation, and the practice of play, which could contribute toward solutions in user engagement.⁶⁸

C. MOTIVATIONAL AFFORDANCES THEORY

Another psychological theory plays into the flow within users of systems. The Motivational Affordances Theory focuses on general motivations for play and seeks to understand how game elements create intrinsically motivating experiences that generate a feeling of flow and energy within an individual.⁶⁹ This theory points to the basic motivational needs of individuals that can be beneficial to its incorporation into the CBP data collection systems presently used by the trade community.

Applications using game design elements to engage a user's behavior within non-game contexts are appearing in increasing numbers.⁷⁰ Several empirical studies demonstrate that attaching game-like features to an activity lead to enjoyment or intrinsic motivation.⁷¹ The use of these factors has the potential to create engagement in data

⁶⁶ John Marshall Reeve, Glen Nix, and Diane Hamm, "Testing Models of the Experience of Self-Determination in Intrinsic Motivation and the Conundrum of Choice," *Journal of Educational Psychology* 95, no. 2 (2003): 376.

⁶⁷ Ibid.

⁶⁸ Ganit Richter, Daphne R. Raban, and Sheizaf Rafaeli, "Studying Gamification: The Effect of Rewards and Incentives on Motivation," in *Gamification in Education and Business*, ed. Torsten Reinert and Lincoln C. Wood (Cham, Switzerland: Springer International Publishing, 2015), 21–46.

⁶⁹ Sebastian Deterding, "Situational Motivational Affordances of Game Elements: A Conceptual Model," in *Gamification: Using Game Design Elements in Non-gaming Contexts*, CHI 2011 Workshop, Vancouver, BC, May 7–12, 2011.

⁷⁰ Ibid.

⁷¹ Ibid.

entry on the part of the trade community and its data transcribers or facilitate a mass collaboration among this group toward the benefit of CBP's border security platform.

D. THEORY OF CO-PRODUCTION

The idea of co-production emerged during the 1970s in the United States when, among other things, analysts became motivated to improve the effectiveness of government services by more closely involving citizens in their creation and implementation.⁷² Coproduction is generally understood to be “the mix of activities that both public service agents and citizens contribute to the provision of public services.”⁷³ The global spread of the Internet and the interconnectedness of people and ideas that it created made coproduction easier. From its earliest days, the Internet has served as a place of social interaction and engagement with information. Improvements in the prevalence and functions of web applications have reduced the barriers for people to work together in the production of content.⁷⁴ Coproduction extends this idea of collective work to government and creates an opportunity for both the public and government to generate content together. In this way, citizens and government collectively work together toward the establishment and delivering of government services and enhancing government performance and quality.⁷⁵

An increasing number of government initiatives focused on expanding coproduction have become available. The implementation of the change.gov website to encourage citizens to provide input, which helped form Obama administration agendas,

⁷² David O. Porter, “Co-Production and Network Structures in Public Education,” in *New Public Governance, the Third Sector, and Co-Production*, ed. Victor Pestoff, Taco Brandsen, and Brad Verschuere (New York: Routledge, 2012), 145.

⁷³ Roger B. Parks et al., “Consumers as Co-producers of Public Services: Some Economic and Institutional Considerations,” *Policy Studies Journal* 9, no. 7 (1981): 1001–1011.

⁷⁴ Tassilo Pellegrini, “A Theory of Co-Production for User Generated Content—Integrating the User into the Content Value Chain,” *econstor*, 2007, 93.

⁷⁵ John Carlo, Bertot, Paul T. Jaeger, and Derek Hansen, “The Impact of Policies on Government Social Media Usage: Issues, Challenges, and Recommendations,” *Government Information Quarterly* 29, no. 1 (2012): 30–40.

serves as one such example of citizen to government participation.⁷⁶ Similarly, governments are making their information more available to the public through open data initiatives that allow communities access to useful reports and statistics via the Internet.⁷⁷ Information exchanges of these varieties hint at the advent of an implicit agreement between government entities and the public that enables the public to be more actively involved in the function of their government.⁷⁸

E. TAPPING INTO THE THEORIES—GAMIFICATION

The aforementioned theories form the psychological principles utilized in the methodology of gamification. Brian Reynolds, former Chief Game Designer of Zynga, plainly characterizes gamification as a system “where you use game elements to try to get people to do stuff they don’t want to do.”⁷⁹ More formally, gamification is the application of game design elements for the purpose of non-game problems, especially for the benefit of improving user engagement and user effectiveness toward overall value creation.⁸⁰ Gamification activities have been credited with increasing social interaction, creating productivity, and improving the quality of information or action through the activity of users.⁸¹ These patterns take effect as a result of intrinsically motivating and positive patterns brought about by the game elements.⁸²

⁷⁶ Dennis Linders, “We-Government: An Anatomy of Citizen Coproduction in the Information Age,” in *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times* (New York: ACM, 2011), 167–176.

⁷⁷ Li Ding et al., “TWC Data-gov Corpus: Incrementally Generating Linked Government Data from data.Gov,” in *Proceedings of the 19th International Conference on Worldwide Web* (New York: ACM, 2010), 1383–1386.

⁷⁸ Linders, “We-Government: An Anatomy of Citizen Coproduction in the Information Age,” 167–176.

⁷⁹ Brian Reynolds, quoted in Yongwen Xu, *Literature Review on Web Application Gamification and Analytics* (Honolulu: University of Hawaii, 2011), 17, http://www.quilageo.com/wp-content/uploads/2013/07/Gamification_11-051.pdf.

⁸⁰ Deterding et al., “Gamification: Toward a Definition.”

⁸¹ Hamari, “Transforming Homo Economicus into Homo Ludens: A Field Experiment on Gamification in a Utilitarian Peer-to-Peer Trading Service,” 236–245.

⁸² Ryan and Deci, “Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-being,” 68.

Game aspects have been studied and their incorporation has been shown to shape and nudge user behavior into directions envisioned and intended by the system designer.⁸³ Several vendors offer gamification as a service layer to computer-based systems. These vendors incorporate reward and notoriety systems with badges, levels, points, and leaderboards, which are designed and have been shown to increase user engagement.⁸⁴ A surprisingly large number of companies provide services focused on gamification and investments are being made into efforts related to implementing gamification within the private sector. The following section reviews gamification as it applies to the e-government and homeland security sectors.

F. USE OF GAMIFICATION TOWARD HOMELAND SECURITY

Gamification is not a new idea. The Greek historian Herodotus tells that, during the kingdom of Atys, the Lydians used to distract themselves during a period of famine by playing games every other day as a way to provide sources of fulfillment to people, and to distract the population from more serious matters.⁸⁵ Presently, lotteries and various forms of gambling are permitted or organized by public authorities, often in conjunction with fiscal objectives. However, gamification as applied in this document would differ from these games for entertainment by applying information received during the process of gameplay toward homeland security objectives.

In February 2012, Jennifer Pahlka gave a TED Talk in which she discussed the creation of an app by her group, Code for America, which was utilized in Boston. Called “Adopt A Hydrant,” the app encouraged the public to assist in their own public safety by maintaining fire hydrants on behalf of the city to ease the task of firemen following

⁸³ Sebastian Deterding et al., “Gamification. Using Game-design Elements in Non-gaming Contexts,” *In CHI’11 Extended Abstracts on Human Factors in Computing Systems* (New York: ACM, 2011), 2425–2428.

⁸⁴ Deterding et al., “Gamification. Using Game-design Elements in Non-gaming Contexts,” 2425–2428.

⁸⁵ Ibid.; Jane McGonigal, “How to Re-Invent Reality without Gamification” (lecture, Serious Games Summit, 2011), <http://www.gdcvault.com/play/1014576/We-Don-t-Need-No>.

snowstorms.⁸⁶ The app allowed people to adopt and name a fire hydrant. It made them responsible for shoveling it out of the snow and for reporting any maintenance issues of which they became aware. If the adopter was not properly overseeing the hydrant, the hydrant could be stolen from them within the context of the game by another person. By turning the maintenance responsibilities into a game, the public became engaged in their own safety and well-being. This app was then repurposed in other municipalities to encourage citizen involvement in the hopes of improving the safety and preparedness of the community. Hawaii has used it to ensure that tsunami warning equipment is maintained, Seattle has used it for maintaining storm drains, and Chicago has used it toward the snow shoveling of sidewalks.⁸⁷ As evidenced by the experiences of Code for America, the use of gamification strategies clearly has a role in enhancing public safety. It is possible that other public sector activities may be improved by gamification.

The use of game methodology and its applications to homeland security activities has been researched for other purposes as well. Crowdsourcing, sometimes related with gamification, has also been viewed as a possible method that can be employed toward homeland security goals. “At its core, crowdsourcing is a method for thousands or even millions of people to contribute their knowledge, expertise, or skills toward a unified task. Done correctly, it has produced results unachievable by traditional tasking of humans or computers.”⁸⁸ Bryan Coultas notes that the majority of people in the United States own a smartphone and existing apps focused on reporting suspicious activities take an average of 15 seconds to activate. He suggests that if personal identification, location data, and a picture were added—information that would be extremely beneficial to an analyst evaluating the data—the time to report would average between 20 and 30 seconds.⁸⁹ By adding a point-based, or some other, awards system, users may be more likely to participate and engage.

⁸⁶ Jennifer Pahlka, “Coding a Better Government,” TED, February 1, 2012, https://www.ted.com/talks/jennifer_pahlka_coding_a_better_government#t-136896.

⁸⁷ Pahlka, “Coding a Better Government.”

⁸⁸ Bryan T. Coultas, “Crowdsourcing Intelligence to Combat Terrorism: Harnessing Bottom-up Collection to Prevent Lone-wolf Terror Attacks” (master’s thesis, Naval Postgraduate School, 2015).

⁸⁹ *Ibid.*, 58.

Enhancement of preparedness to prevent attacks is one of the major goals of the homeland security enterprise as outlined in the Homeland Security Presidential Directives.⁹⁰ The need for continual engagement and information gathering is vital, particularly given the unexpected nature of security incidents. However, the ever-changing dynamics seen among border security agencies may limit their abilities to perform these functions. The DHS and other government agencies are working on ways to adapt to fluctuations within their respective needs while still maintaining the value and efficacy of existing programs. Within this setting, modification using gamification presents government agencies an alternative to ensure its continued success in the areas of engagement and readiness.⁹¹ It may be possible for DHS agencies engaged in border protection to utilize game-like features toward achieving mission goals outlined within presidential guidance.

G. PROS AND CONS OF GAMIFICATION

In the recent era, gamification has emerged as a promising technique toward the enhancement of user engagement and the fostering of collaborative methods. A common objective of gamification's use is to push user participation rates higher by making a user's experience with a system more appealing and enjoyable to address the challenge of minimal contributions from users, as well as lowering attrition rates of systems.⁹² Simultaneously, through choices in the design of systems, implementers are able to drive changes in the behaviors of the newly engaged audience. Previous research has found that the use of game design elements in non-gaming contexts is in line with self-determination theory and flow theory especially, "autonomy, competence and relatedness determine

⁹⁰ Homeland Security Presidential Directive (HSPD)-5 had instructed the Secretary of Homeland Security to establish the common coordinating structures to prepare for and respond to terrorist attacks, major disasters and other emergencies. HSPD-5 was extended by HSPD-8 to "help ensure the preparedness of the Nation to prevent, respond to, and recover from threatened and actual domestic terrorist attacks, major disasters, and other emergencies." George W. Bush, *Homeland Security Presidential Directive 5* (Washington, DC: The White House, 2003); George W. Bush, *Homeland Security Presidential Directive 8* (Washington, DC: The White House, 2003).

⁹¹ Juho, Koivisto, and Sarsa, "Does Gamification Work? A Literature Review of Empirical Studies on Gamification."

⁹² Surya Nepal, Cecile Paris, and Sanat Bista, "Gamification on the Social Web," in *Social Media for Government Services*, ed. Surya Nepal, Cécile Paris, and Dimitrios Georgakopoulos (Cham, Switzerland: Springer International Publishing, 2015), 201.

players' motivations in playing games.”⁹³ Previous attempts at applying these principles towards DHS priorities have shown the effectiveness of the methods.

Arizona State University conducted tests to look at gamification strategies in the use of incident command in comparison to existing table-top exercises as a training tool. They found that tabletop exercises were good for evaluating existing plans, but were not effective in facilitating consequence evaluation of decisions made as a result of time constraints.⁹⁴ The team sought to use gamification strategies to increase effectiveness in this area. As of this writing, success results are inconclusive and more research from this group is warranted.

A team from the University of Illinois at Chicago has also looked at using gamification strategies to facilitate exercises by conducting virtual operations concentrated on planning, training, and evaluation for federal, state, and local workers, as well as emergency volunteers by creating a training archipelago called Public Health Preparedness within the online game “Second Life.”⁹⁵ The virtual island chain designed by the team offers a multitude of rural and urban environments and allows for custom environments, objects, and scripts related to emergency scenarios ranging from dirty bombs to bioterrorism and pandemic influenza.

Training exercises began in late 2006. The team found that it is beneficial to use the online game to conduct virtual exercises rather than live or other traditional training methods.⁹⁶ Their research provides perspective on how online games and virtual platforms can be utilized to train individuals and displays significant upsides to gamification strategies in the area of homeland security.

⁹³ Irfan E. Kanat et al., “Gamification of Emergency Response Training: A Public Health Example,” in *Intelligence and Security Informatics, IEEE International Conference on Intelligence and Security Informatics* (Seattle, WA: IEEE, 2013), 134–136, <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6578802&isnumber=6578763>.

⁹⁴ Kanat et al., “Gamification of Emergency Response Training: A Public Health Example,” 134–136.

⁹⁵ Colleen Monahan, Lars Ullberg, and Kevin Harvey, “Virtual Emergency Preparedness Planning Using Second Life,” in *Service Operations, Logistics and Informatics, 2009. SOLI'09*, IEEE/INFORMS International Conference on Service Operations, Logistics and Informatics (Chicago: IEEE/INFORMS, 2009), 306–310.

⁹⁶ Ibid.

Critiques of gamification are available from various sources. Margaret Robertson, former President of the game design studio Hide&Seek, referred to it as merely a buzzword. She claims that many confuse the term gamification with a superficial “pointsification,” which is missing elements and experiences at the core of how games work.⁹⁷ She argues that points and badges are the least important parts of gaming. Rather, the rich cognitive and emotional elements are what designers should focus on to receive the desired engagement from an audience.

Less critical is researcher Sebastian Deterding who, in his Google tech talk “Getting Gamification Right,” critiques the practices of simple gamification and stresses the importance of “meaningful play” with clear well-ordered, structured, and achievable goals that “pull you through the game experience.”⁹⁸ In the same way, Jane McGonigal emphasized the aspect of “playfulness” in gamification instead of overarching game mechanics during a presentation at the Serious Games Summit in 2011.⁹⁹ Gamification is becoming an area of study in which some debate occurs focused on whether it is a meaningless buzzword or a new tool with the potential to change the world.

Ethical questions raised over whether gamification itself is inherently good have also been brought up amongst the academic community. Concerns regarding whether or not gamification is motivated by ill intentions and are designed to “dupe people into doing things that aren’t necessarily in their best interest” have been raised.¹⁰⁰ However, also recognized is the possibility that some attempts at gamification may simply be poorly executed, resulting in passing effects that fail to alter people’s behavior in lasting and positive ways.¹⁰¹

⁹⁷ Margaret Robertson, “Can’t Play, Won’t Play,” HideandSeek.net, accessed January 4, 2017, <http://hideandseek.net/2010/10/06/cant-play-wont-play/>.

⁹⁸ Sebastian Deterding, “Meaningful Play: Getting Gamification Right,” YouTube video, Google Tech Talk presented January 24, 2011, posted online February 18, 2011, <https://www.youtube.com/watch?v=7ZGCPap7GkY>.

⁹⁹ McGonigal, “How to Re-Invent Reality without Gamification.”

¹⁰⁰ Yongwen Xu, *Literature Review on Web Application Gamification and Analytics* (Honolulu: University of Hawaii, 2011), 21, http://www.quilageo.com/wp-content/uploads/2013/07/Gamification_11-051.pdf.

¹⁰¹ Ibid.

H. CONCLUSIONS

Some work has been done to identify possible applications of game methodology toward homeland security goals; however implementation is in its infancy. Although research suggests that CBP's and DHS's activities and goals may benefit greatly from incorporation of this stratagem, presently, CBP does not engage in gamification of its various systems. CBP systems are largely text-based with limited enhancements that encourage the user engagement described in the various psychological theories employed toward gamification and social media approaches. While criticisms exist regarding the use of gamification strategies overall, enough academic research does support its claims as a motivational tool that may be employed by CBP in the furtherance of its goals. It is therefore justified to review CBP programs to identify areas in which CBP systems may benefit from these methods.

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IV. GAMIFICATION AS AN ALTERNATIVE APPROACH

E-governance allows for the participation of the public in governmental actions. It is not simply about electronic access to government materials but rather about how citizens relate to each other and their government. This chapter explains the concept of gamification, its use in various sectors, and strategies for leveraging it to improve the collection of data for the purposes of maritime border security. This chapter also explores the possibility of modifying present data collection methods to adopt a gamified approach, thus enhancing the e-government sphere.

A. INTRODUCTION TO GAMIFICATION—WHAT IT MEANS TO HOMELAND SECURITY

Gamification is the use of game design elements for the purpose of non-game contexts and has implications throughout a variety of fields. As an emerging phenomenon, the concept has been seen in many different business and social areas and a surprising number of gamification elements have applied game dynamics toward non-gaming enterprises. In the commercial world, for example, major retailers employ loyalty programs that grant discounts or other incentives to users. In this way, these programs create a tangible benefit for the people who use the services. Social media websites employ badges and other benefits to entice individuals toward engagement. websites, such as LinkedIn, incentivize participation in creating content and data, as well as providing feedback to users regarding the number of visitors to their pages and other information relevant to the users' goals.¹⁰² As an increasing number of groups recognize that games can have important motivational and behavioral effects, a growing number of services have been gamified in the hopes of improving user engagement and loyalty.

Although gamification elements are used to create game dynamics in non-gaming environments, the actual performance of the gamification process largely depends on an

¹⁰² Nepal, Paris, and Basa, "Gamification on the Social Web," 208.

effective design.¹⁰³ Effective game design stems from the application of systems and psychological factors that encourage the creation of a *flow state* among users. Hence, the elements of points, badges, and other forms of extrinsic rewards contribute to mechanisms of gamification by encouraging the development of motivation among participants. A variety of elements can be combined to create a psychologically engaging system; competition that occurs among users, scoring systems, rewards and feelings of achievement, and other motivators all encourage engagement and activity. Thus, understanding these elements and modeling their connections serve as a primary step toward gamification design.

The use of gamification strategies in the homeland security arena has the potential to alter substantially the ways in which government services prepare for and respond to significant events. Incorporating information received or developed through gamified methods can lead to better decision making, efficiencies of services, and a more informed public understanding of actions undertaken. Such benefits combine to make a more effective government system, and when applied to the DHS, can serve to make a leaner, smarter, more responsive agency that is better equipped to protect the nation.

1. Leveraging Fun

Gamification centers around the creation of playfulness in non-game environments, so participation and enjoyment are derived by those completing a task. Examples in the private sector point to the practical uses of employing game techniques toward the completion of objectives. By applying psychological factors that activate internal drivers among those engaging in a task, a designer not only involves a user but also enhances productivity and interest in the end result.

Research conducted by Edward Deci, which led to the development of self-determination theory, points to the intrinsic motivations created when a subject becomes interested in a task. In 1970, Deci, a psychologist conducting research at the University of

¹⁰³ Alberto Asquer, "Not Just Videogames: Gamification and its Potential Application to Public Services," *Digital Public Administration and E-Government in Developing Nations: Policy and Practice*, 9, April 25, 2014, https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2429345.

Rochester, created an experiment to test voluntary engagement among participants. Using a puzzle game called Soma, which featured seven uniquely shaped pieces that could be combined into various shapes, individual participants were given one hour to assemble the pieces into three or four challenging shapes described in diagrams provided by Deci. After observing the participants for most of an hour, Deci would notify participants that they could take a break and would leave the room. During his absence, the real experiment began. Deci observed the participants through a one-way mirror for a period of eight minutes. The room was full of magazines and other distractions; however, even with Deci out of the room, many subjects continued to work on the puzzle. Participants spent an average of four minutes of the break working on it with no incentive other than the stimulation and fun of the task itself. Deci then released the subjects, having acquired a baseline for the participant's voluntary engagement with the puzzle.

As a test that displayed the impacts of extrinsic motivators, a second experiment with the same subjects was conducted. During this experiment, payment was added as an incentive for each completed shape, and participants worked for an average of five minutes during the break time. However, when a third session was added, this time with the payment removed, the average time spent working on the puzzle by participants dropped down to three minutes. The memory of being paid earlier lessened their engagement even though they were happy to play with the puzzle voluntarily during the first session. Deci concluded that human motivation is not reliant specifically on external incentives—although they may help. The experiment suggests that increasing extrinsic motivations—money, for example, is not necessarily as effective as encouraging internal drivers, and increasing extrinsic motivators may conversely decrease intrinsic motivations.¹⁰⁴

Even the simplest of games can lead to success and increase participation in a workforce. In the mid-2000s, the retail chain Target addressed problems with the sluggishness of cashiers by adding a function to their registers that became known internally as the *Target Checkout Game*. Checkout screens would display letters

¹⁰⁴ Clay Shirky, *Cognitive Surplus: Creativity and Generosity in a Connected Age* (East Rutherford, NJ: Penguin Press, 2012), Kindle edition.

indicating whether the speed between each scan of an item was fast enough or not. At the end of the transaction, a percentage would display on the screen indicating the employee's cumulative transaction rate. As a result, employees reportedly began taking pride in achieving a high-score on their transaction rate, and better still, beating previous scores.¹⁰⁵ Not only did Target's checkout lines move faster, but job satisfaction among employees increased. The tedium and dullness experienced by employees disappeared when they began viewing the results as a game.¹⁰⁶

In his book *Drive: The Surprising Truth about What Motivates Us*, Daniel Pink studies the science of motivation and how intrinsic and extrinsic rewards impact behavior. He concludes that the effects of extrinsic rewards can wear off. He suggests that intrinsic rewards are more beneficial for long-term engagement. He concludes that intrinsic motivators are made up of three essential elements: autonomy or the wish to direct our own lives, mastery or the impulse to progress and get better at something, and purpose or the desire to act in service of something larger than ourselves.¹⁰⁷

Additional examples of gamification and intrinsic motivators derived from the lessons of Deci's research are plentiful. The Nike+ smartphone app employs game mechanics for runners to compete and improve their fitness.¹⁰⁸ From its launch in 2006 through April 2015, the system gained a user base of 28 million people due to its engaging platform, which turns exercise into a game.¹⁰⁹ The system makes it easy for runners to challenge themselves and their friends and to upload their run data to a website.¹¹⁰ This data upload allows the company to gather information on its users'

¹⁰⁵ Gabe Zichermann and Joselin Linder, *The Gamification Revolution: How Leaders Leverage Game Mechanics to Crush the Competition* (New York: McGraw Hill Professional, 2013), loc 1184, Kindle edition.

¹⁰⁶ Ibid.

¹⁰⁷ Daniel H. Pink, *Drive: The Surprising Truth about What Motivates Us* (London: Penguin, 2011).

¹⁰⁸ "Nike+ Run Club App," accessed February 27, 2017, http://www.nike.com/us/en_us/c/nike-plus/running-app-gps?cp=usns_kw_nike_null_txt!g!c!br!e!nike%20plus&k_clickid=3420ad76-e68c-4074-84d5-7c2b89d8006a.

¹⁰⁹ Sheta Mittal, "Run with Data on Nike+," Harvard Business School, 2015, <https://openforum.hbs.org/challenge/understand-digital-transformation-of-business/data/run-with-data-on-nike>.

¹¹⁰ "Nike+ Run Club App."

behaviors that helps shape Nike's future product designs and keeps users interested in the activity and the Nike brand.¹¹¹ Other smartphone apps, like Leaffully, help users track energy usage, alerting them when consumption is abnormally high or impressively low by displaying green trees and animations. Games like Microsoft's Ribbon Hero and Ribbon Hero 2 make clerical and administrative workers better at their jobs by helping them discover Microsoft Office features in fun ways. The game requires players to build familiarity with the interfaces of various Microsoft Office products to advance from one level to another, which allows players to learn what types of features are available and how to use them.¹¹²

Such games encourage people to engage in tasks and change behaviors without requiring the awareness of the effect among participants. The game mechanics serve to give people a sense of control and infuse a level of competition and challenge. Through the act of play, a sense of accomplishment develops, and therefore, a desire to continue pursuing the challenge and playing the game.

2. Current Approaches to Gamification or Crowdsourcing in the Government Services Internationally

Gamification and variations on its methods have been successfully employed toward security arenas in other regions globally. Large-scale disasters in Australia have used the methods for coordinating the efforts of disaster response groups throughout affected areas.¹¹³ In January 2013, Tropical Cyclone Oswald damaged the Queensland and New South Wales regions, causing flooding, downed power lines, and smashed windows, and contributed to \$2.5 billion in damages as a result of natural disasters during that year.¹¹⁴ Central to the response and recovery were effective and accurate

¹¹¹ Mittal, "Run With Data On Nike+."

¹¹² "Ribbon Hero 2," 2011, <https://www.microsoft.com/en-us/download/details.aspx?id=26531>.

¹¹³ Robert Power, Bella Robinson, and Catherine Wise, "Using Crowd Sourced Content to Help Manage Emergency Events," in *Social Media for Government Services*, ed. Surya Nepal, Cécile Paris, and Dimitrios Georgakopoulos (Cham, Switzerland: Springer International Publishing, 2015), 249.

¹¹⁴ Queensland Government, *Budget Paper, Queensland's Natural Disasters 2013–14* (Queensland, Australia: Queensland Government, 2013), <http://www.parliament.qld.gov.au/Documents/TableOffice/TabledPapers/2013/5413T2788.pdf>.

information sharing regarding environmental impact, the damage and status of infrastructure, as well as the condition of the country's populations, but no such mechanism to gather and organize this information existed.¹¹⁵

Australia developed a solution that could coordinate and catalogue information vital to its response mechanisms. The country employed a software application that uses data extracted from Twitter.¹¹⁶ Known as the "Emergency Situation Awareness" tool, this gamified system applies the ideas of co-production by using information generated by the public and posted on Twitter to identify and describe emerging events. The home page, as shown in Figure 2, uses gamified elements, such as the real-time burst detector in which bursting words are identified based on the frequencies of the words. The burst detector creates an alert when the frequency of occurrence of an observed word strongly differs from the programmed language model, which calls the attention of the user who can coordinate the required response.¹¹⁷ Also included is an alert heatmap that indicates the distribution of the geographical origins of Twitter messages. These engaging methods that both poke at the user and force their participation combine to create a useful emergency tool that conveys real-time information to emergency managers in an easily organized and engaging, thus gamified, format. Due to the style used for the aggregation and display of information, reviewers of the data can quickly process and characterize the veracity of the information and provide resources as appropriate to affected areas. The tool has been used to detect and describe emergency events, notably earthquakes, as well as to monitor ongoing potential disasters, such as fires and cyclones, with considerable success.¹¹⁸ The system exemplifies how the application of gamified concepts can apply to real-world safety and security issues.

¹¹⁵ Power, Robinson, and Wise, "Using Crowd Sourced Content to Help Manage Emergency Events," 249.

¹¹⁶ Twitter is an online news and social networking service where users post and interact with messages. These messages, known as "tweets," are restricted to 140 characters and speak to a variety of topics and interests. They form the basis of Twitter services.

¹¹⁷ Power, Robinson, and Wise, "Using Crowd Sourced Content to Help Manage Emergency Events," 249.

¹¹⁸ *Ibid.*, 268.

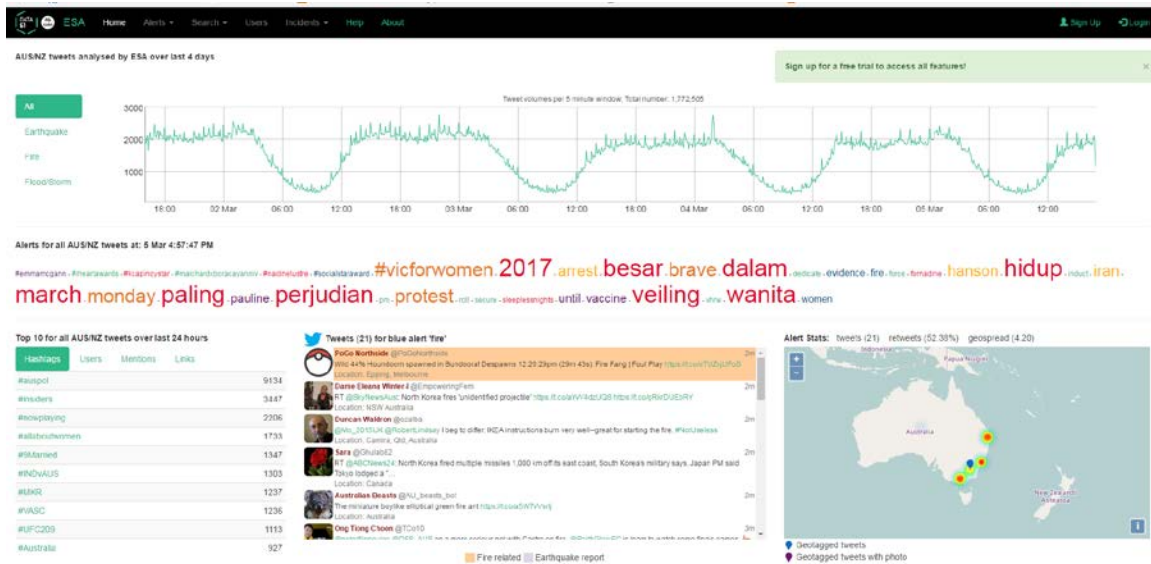


Figure 2. Screenshot of Emergency Situational Awareness Toolkit Homepage¹¹⁹

The nation of France has reversed the information sharing associated with major events. Following the terrorist attacks of 2015 and 2016, France determined that an improved notification system that alerts its population of events within their geographic area was something that they should pursue. Made available in June 2016, the Population Alert and Information System (SAIP in its French acronym) is a downloadable tool for use on smartphones and can provide information on a variety of categories and situations, including terrorist events and nuclear incidents.¹²⁰ As a tool available to the public, the system uses icons, alerts, badges, and other basic gamified incentive methods to generate attention and interest in its use.

The differences in gamification application internationally are vast, but the concepts are so universal that they can be applied to many problems. Figure 3 displays two examples utilizing gamification in service of communities. In one, information is received from individuals by their government and interpreted to provide needed

¹¹⁹ "Home," accessed March 5, 2017, <https://esa.csiro.au/ausnz/index.html>.

¹²⁰ Pierre Longeray, "The French Government Has an App to Warn People about Terror Attacks and Nuclear Disasters," *VICE News*, June 10, 2016, <https://news.vice.com/article/the-french-government-has-launched-an-app-to-warn-people-about-terror-attacks-and-nuclear-disasters>.

services. In the other, information is provided by the government for the safety and security of users. Both serve as examples of how simple gamified methods can be used in a public and private partnership for the benefit of both groups.

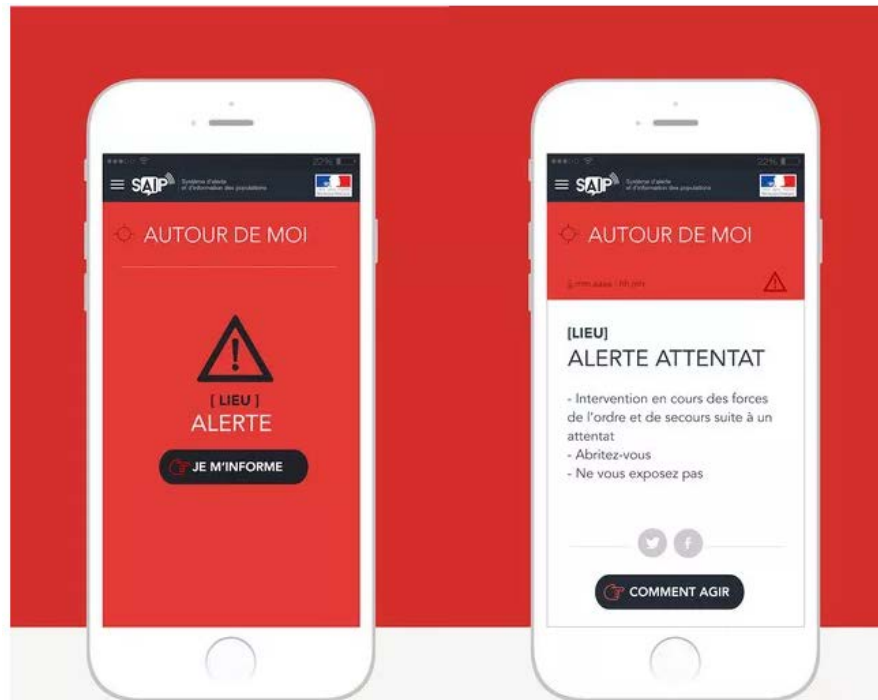


Figure 3. Terror Attack Warning within the Population Alert and Information System¹²¹

3. Getting Serious about Gaming—Direct Application to the DHS

A developing area of games studies known as “serious games” aims to leverage the capacity of games to address significant global challenges.¹²² Gamification as it applies to the DHS falls mostly into this category. While the typical primary goal of games is to entertain, their diverse applicability can provide extra functions. Serious games represent one such area in which these extra functions are applied. In serious

¹²¹ Amar Toor, “France Launches Terror Alert App Ahead of Euro 2016 Tournament,” *The Verge*, June 8, 2016, <https://www.theverge.com/2016/6/8/11881732/france-terrorism-alert-euro-2016-app>.

¹²² Geoffrey M. Rockwell and Kevin Kee, “The Leisure of Serious Games: A Dialogue,” *Game Studies* 11, no. 2 (May 2011), http://www.gamestudies.org/1102/articles/geoffrey_rockwell_kevin_kee.

games, the main purpose is to train, investigate, or advertise.¹²³ Games in this category address political, social and cultural issues, thereby transcending the limitations of traditional games.¹²⁴

In 2012, Chad Gorman reviewed the use of videogame-based learning as a tool to enhance nuclear terrorism preparedness.¹²⁵ His research revealed that games represent a practical mechanism that may allow the preparedness community to enhance its effectiveness and increase its impact among members of the public. He believes that through managed risk and improvements in methods and user familiarity over time, the ability of games to influence community preparedness would improve. His analysis of gaming dynamics indicates that the enactment of approaches using game features toward nuclear preparedness would inspire the engagement of the audience while also providing those players with the knowledge and proficiency required to survive a nuclear event. The engagement that he found in his research is the same level of activity necessary to forward the goals of border security for CBP. Despite regulatory requirements, the import community still fails to provide information necessary for CBP shipment vetting within necessary timeframes. If the import reporting process could be gamified, the import community would be motivated to provide the data that CBP needs to help secure the borders.

Crowdsourcing, sometimes related with gamification, has also been viewed as a possible method that can be employed toward homeland security goals. “At its core, crowdsourcing is a method for thousands or even millions of people to contribute their knowledge, expertise, or skills toward a unified task.”¹²⁶ When used correctly, crowdsourcing can produce results not possible through traditional efforts of humans or computers.”

¹²³ Richter, Raban, and Rafaeli, “Studying Gamification: The Effect of Rewards and Incentives on Motivation,” 21–46.

¹²⁴ Josh Schollmeyer, “Games Get Serious,” *Bulletin of the Atomic Scientists* 62, no. 4 (2006): 34–39.

¹²⁵ Chad Gorman, “Getting Serious About Games-Using Video Game-based Learning to Enhance Nuclear Terrorism Preparedness” (master’s thesis, Naval Postgraduate School, 2012).

¹²⁶ Coultas, “Crowdsourcing Intelligence to Combat Terrorism: Harnessing Bottom-up Collection to Prevent Lone-wolf Terror Attacks.”

Within CBP's data collection systems, gamification has the potential to inform and improve existing policies. This development includes teaching risks associated with noncompliance with existing regulations and the overall goals related to public messaging, as well as the gathering of information used for research related to border security. By providing more detailed and potentially more complete information about the transit of containers, the intention and risk of the cargo, and of involved parties, the incorporation of game elements in ISF data systems may improve the program's performance.

Changes that flow from the idea that systems need to be modernized have already been implemented in other arenas and modification to existing methods of data collection mirror those experienced with other advances in DHS systems. An evaluation of the TECS system by the DHS in 2008 found that "user interfaces and architecture [were] dated, limiting ease of use and flexibility to respond to emerging needs."¹²⁷ The DHS's solution was to develop a modernized system that provides a more efficient product meant to serve its government user base better. Included among the benefits of this process were improvements with how intelligence information was controlled, and consistency in the procedures used to manage processes.¹²⁸ It is probable that the modernization of other government systems through emerging processes, such as gamification, may yield similar results.

¹²⁷ U.S. Department of Homeland Security, *Department of Homeland Security Office of the CIO E-Government Act Report of 2008* (Washington, DC: U.S. Department of Homeland Security, 2008), https://www.dhs.gov/sites/default/files/publications/cio_egov_annual_report_2008_0.pdf.

¹²⁸ *Ibid.*, 8.

V. IMPLEMENTATION

A certain degree of uncertainty about the expected consequences of the innovation still exists...at the implementation stage.

~ Everett M. Rogers—Diffusion of Innovations

Federal policy initiatives related to maritime security have three core goals.¹²⁹ First, they seek to detect and mitigate the susceptibility of risk for port facilities, vessels entering seaports, and port infrastructure. Second, they aim to secure the freight streaming through the various seaport complexes. Third, they are designed to develop greater awareness of the entire global maritime domain. To accomplish these goals, a number of programs contributing to a layered enforcement strategy are utilized. The importer security filing requirement is one such program designed to satisfy all three core concepts of policy initiatives for maritime border security. ISF requirements seek to accomplish these goals by providing information intended to enable CBP to monitor and evaluate the transit of cargo more closely between a foreign source and a final U.S. destination. Additionally, it acquires this information by enlisting the private trade community to provide this data.

A. GAPS IN EXISTING POLICY AND ATTEMPTS TO ADDRESS THEM

Internal policies of CBP related to how the agency responds to parties that fail to provide required ISF information does not create significant incentive to follow guidelines. Rather, the tendency to issue penalties only to repeat violators of reporting requirements, those who fail to use “reasonable care,” or parties “significantly late” in the filing of ISF information, may reduce the perception of urgency and reduce incentive for timely participation.¹³⁰ Information gathered under the ISF program is intended to

¹²⁹ Margaret T. Wrightson, *Maritime Security: Enhancements Made, But Implementation and Sustainability Remain Key Challenges, Testimony before the Committee on Commerce, Science, and Transportation, U.S. Senate* (GAO-05-448T) (Washington, DC: Government Accountability Office, 2005), 17.

¹³⁰ “Do I Need a License to Import Something,” accessed March 3, 2017, https://help.cbp.gov/app/answers/detail/a_id/197/noIntercept/1.

provide CBP with the ability to review data elements of cargo well in advance of its arrival to the United States to evaluate elements of risk. Since data may not be received timely under such policies, the overall effectiveness of the program is impacted.

The use of gamification within the context of ISF aims to increase trade community participation via DHS web-based systems by inviting the active participation of citizens in the delivery of services. The success of this endeavor is dependent on the active participation of citizens and private-sector interests in these platforms, further incentivized through the inclusion of motivational factors unrelated to financial penalties.

Since CBP collects this information via the Internet, the use of gamification toward these goals seeks to fulfill additional policy requirements focused on the e-government sphere set forth in the E-Government Act of 2002.¹³¹ This act was passed to promote and enhance the management of electronic government processes. This law's stated goals, among other areas, focus on:

- [Promoting the] use of the Internet and other information technologies to provide increased opportunities for citizen participation in Government.
- [Improving] the ability of the Government to achieve agency missions and program performance goals
- [Transformation] of agency operations by utilizing, where appropriate, best practices from public and private sector organizations.
- [Reduction] of costs and burdens for businesses and other Government entities.
- [Promotion] of better informed decision making by policy makers¹³²

Inclusion of gamification methodologies within ISF data collection systems would potentially benefit each of the goals of this act. Use of these methods, common within the private sector, would better utilize online government tools and improve the performance of an existing program. It would theoretically reduce burdens for trade groups, since fewer financial penalties would be assessed, as well as to the government,

¹³¹ E-Government Act of 2002, Pub. L. No. 107-347, House Resolution 2458 (2002).

¹³² Ibid.

since CBP personnel would require fewer resources to process the reduction in penalties. The enhanced data would also promote more informed assessments of deployment for inspectional assets and personnel by policy makers within CBP.

B. APPLICATION

Thinking practically about applying gamification toward homeland security, specifically CBP concerns, requires a need to separate the hype from the reality. Many government organizations are understandably skeptical about the effectiveness of games; however, the application of psychological principles in the private sector has shown the utility of this method. Gaming is by no means a replacement for the existing methodology of the ISF program, but it has tangible benefits that could ultimately enhance established approaches and result in a more flexible and wider-reaching program.

In the case of data transcribers represented by the trade community, the entry of information into systems can be tedious. People cannot be expected to do the same thing day-in and day-out long-term and maintain the same level of enthusiasm for the task.¹³³ Gamification Corporation founder Gabe Zicherman believes “gamification is good at bringing [the] concepts of motivation and engagement back to people who may have lost connection with their job.”¹³⁴ Due to its enticing nature, gamification, when done well, can offer a revitalizing method to encourage participation in ISF data entry and invigorate activity among the uninterested.

Trade industry users of CBP systems are generally motivated by external motivators, such as earning a paycheck or avoiding financial penalties that may be levied for failing to comply with regulations; however, as noted in Deci’s work, games influence audience engagement primarily by feeding the intrinsic motivations of

¹³³ Colin Wood, “Gamification: Governments Use Gaming Principles to Get Citizens Involved,” Government Technology, 2013, <http://www.govtech.com/local/Gamification-Governments-Use-Gaming-Principles-to-Get-Citizens-Involved.html>.

¹³⁴ Ibid.

participants.¹³⁵ Activating intrinsic motivators can drive people to alter their overall behavior and engross them with a task in a manner very different from the extrinsic factors presently used by CBP. Dignan describes the feeling as *groking*: “to understand it so thoroughly that it becomes a part of you.”¹³⁶ To be successful in creating an urgency to participate within users of its systems, CBP must generate a spirit of enjoyment, provide users a challenging experience that motivates their involvement in the game, and encourage them to *grok*.

C. A STRATEGIC APPROACH FOR GAMIFICATION

Researchers Kim and Leem suggest a process model for implementing gamification. Their model comprises seven parts and is detailed in Figure 4. In their model, the first step of implementation is a business-strategy analysis that includes a review of the mission, objectives, and strategy of the organization. The second step includes an analysis of the business and technical environments. The “to-be” step defines the scope of the project and goals. It clearly defines what is and is not included within the area of work to be completed.¹³⁷ That step is followed by assessments of the current procedures, accompanied by a risk analysis of proposed changes. Last comes the modeling of the gamified system and the final planning of implementation processes.

¹³⁵ Ryan and Deci, “Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-being.”

¹³⁶ Aaron Dignan, *Game Frame: Using Games as a Strategy for Success* (New York: Simon and Schuster, 2011), 4–5.

¹³⁷ Sangkyun Kim, “Fundamental Strategic Approach for Gamification: How to Start a Gamification in Your Organization,” *International Journal of Digital Content Technology and its Applications*, August 2013.

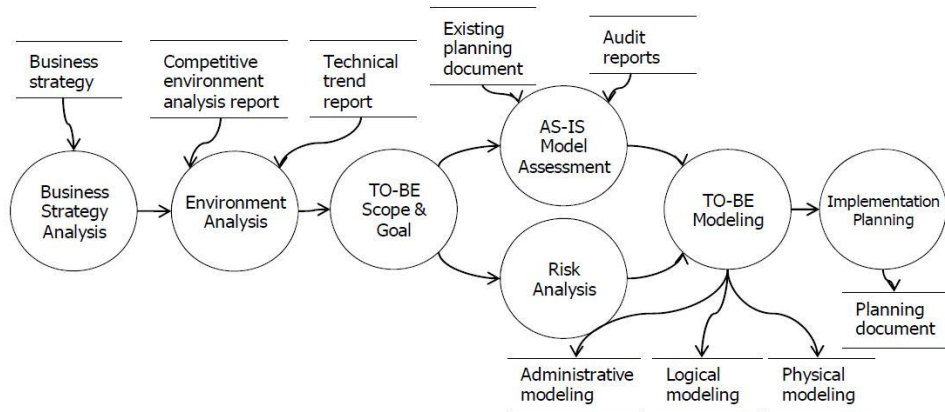


Figure 4. Kim and Leem's Process Model for Gamification¹³⁸

Kim and Leem's research primarily provides the first steps of gamification, establishing the method, as well as identifying an area in which it may be applied. As applied to ISF gamification, its use primarily focuses on the feasibility of game technologies within maritime security but stops short of dictating the exact style or game elements that should be employed.

D. THE HOW OF ISF GAMIFICATION

1. Summation of Analysis

As companies using CBP systems vary in size and import frequency, and because even their access and use of systems sometimes differ, CBP faces some challenges in putting together such a program. Two concurrent strategies to CBP's ISF data collection exist. Importers who file infrequently have the ability to file up to 12 ISFs annually through the ISF Portal, a CBP owned and managed system provided to smaller trade entities.¹³⁹ Those who file more than 12 ISFs annually are not permitted to use the ISF Portal but instead use software provided by a third-party vendor to transmit the required

¹³⁸ As depicted in Kim, "Fundamental Strategic Approach for Gamification: How to Start a Gamification in Your Organization."

¹³⁹ U.S. Customs and Border Protection, *Benefits of ACE for Importers Fact Sheet*.

information.¹⁴⁰ Since larger companies generally file more than 12 ISFs annually, they are more likely to use a third-party vendor system for data transmission. Conversely, smaller-scale importers, for whom CBP has the least historical compliance data, may file ISF data through the CBP owned and managed system. Smaller-scale importers are also less likely to participate in one of CBP's trusted trade-partner programs, such as the Customs-Trade Partnership Against Terrorism (C-TPAT). As less is known about individual importers within this group, members are most likely to be responsible for cargo that requires more extensive review of data by CBP targeters, and may also be viewed as more at-risk cargo when ISF is improperly filed. Freight from these importers would benefit more significantly from the advanced data required under the ISF program.

Since this group is more likely to utilize a CBP-owned system, they also represent the easiest group to impact with a gamified system. Thus, the simplest solution toward employing gamification is to create changes that impact this smaller contingent. In doing so, CBP not only creates a system that works toward enhancing maritime border security but also lays a foundation for future growth and enhancement of methods. Being too ambitious and starting with the larger companies at the outset may actually delay positive results. Clay Shirky notes that fixating on "creating large-scale future success can actually reduce the possibility of creating the small-scale here-and-now successes needed to get there."¹⁴¹ It is much better to create a small functional system and expand on the lessons and ideas enacted during the process of implementation than it is to start with a large unexceptional system and work on making it better.

2. Challenges with Implementation

Everett Rogers states, "It is one thing for an individual to decide to adopt a new idea, quite a different thing to put the innovation to use, as problems in exactly how to use the innovation crop up at the implementation stage."¹⁴² The unique nature of the

¹⁴⁰ Software vendors who are certified to submit transactions to CBP updated regularly. A comprehensive list of certified vendors can be found at <https://www.cbp.gov/document/guidance/abi-software-vendors-list>.

¹⁴¹ Shirky, *Cognitive Surplus: Creativity and Generosity in a Connected Age*, 194.

¹⁴² Everett M. Rogers, *Diffusion of Innovations*, 5th ed. (New York: Free Press, 2003), 179.

proposed gamification technologies, and the reason that they are appealing as government tools, rests in their capacity to produce immediate and direct engagement among the employees of trade entities using government systems. Nevertheless, this nature also creates challenges since employment of these technologies will modify existing systems. Although present policies address many concerns, such as privacy and security, policies and methods related to DHS electronic systems predate the use of game contexts as proposed. As a result, some of the existing structures may not sufficiently address the technical needs of gamification.

3. Proposed Wireframe for Implementation

The use of gaming dynamics requires effective design strategies for use within CBP systems. This section does not include specific guidance for systems that should be created; rather it represents possibilities for implementation based on the research contained herein. Gamification elements used in Figures 5 and 6 are borrowed from popular gamified systems, such as Facebook, LinkedIn, and other sources referenced in the previous chapters. These images largely feature visual elements which, according to gamification expert Mario Herger, allow users to immerse better in a gaming system.¹⁴³ The images are not to be seen as the only means for the application of gamification methodology within CBP data collection systems, but as a starting point for the development of efficient and improved systems.

¹⁴³ Mario Herger, *Enterprise Gamification: Engaging People by Letting Them Have Fun: Book 1-The Basics* (North Charleston, SC: CreateSpace Independent Publishing Platform, 2014), Kindle edition.

The figure displays two screenshots of the 'importer security filing portal' interface. The top screenshot shows the initial state of the form, and the bottom screenshot shows the form after data entry with immediate feedback.

Portal Header: importer security filing portal

Navigation Tabs: New Filing, Search, Account Settings, Reports, Badges

Filing Information Section:

- Filing Type:
- ISF Importer Number:
- ISF Shipment Type:
- Action Reason Code:

Bond Information Section:

- ☐ Continuous ☐ Single Transaction
- Select from Continuous Bonds on file:

Bills of Lading Section:

- Bill of Lading Number:
- Bill of Lading Type:

Progress and Badges Section:

- Your Progress: 27% Complete (2 min)
- Earned Badges: Power User, Cargo Mover, Port Protector, etc.

Feedback Mechanisms (Bottom Screenshot):

- Filing Type: ☒ (Green checkmark)
- ISF Importer Number: ☒ (Green checkmark)
- ISF Shipment Type: ☐ (Red X)
- Action Reason Code:

Figure 5. Proposed Template for the Importer Security Filing Portal

The addition of immediate feedback mechanisms, such as those depicted with check boxes in Figure 5, help a user feel more involved with a process. Live checks of information submitted by users should be conducted to verify the validity of data provided immediately to ensure that it meets established format requirements, and if

possible, cross-references, responds, and correlates to information submitted by other shipping parties. If it does not, real time indications that the data is flawed should be provided to encourage a user to update as appropriate.

As seen in popular games like “Candy Crush,” or the gamified web design of Amazon.com, creating a sense of progress creates a feeling for the user of flow. When they feel stuck and confused, the natural reaction of a user is to abandon the action.¹⁴⁴ Dynamic feedback features encourage users to engage more with the system. Lastly, screens that indicate milestones create and encourage additional interaction with the system, as seen in Figure 6.

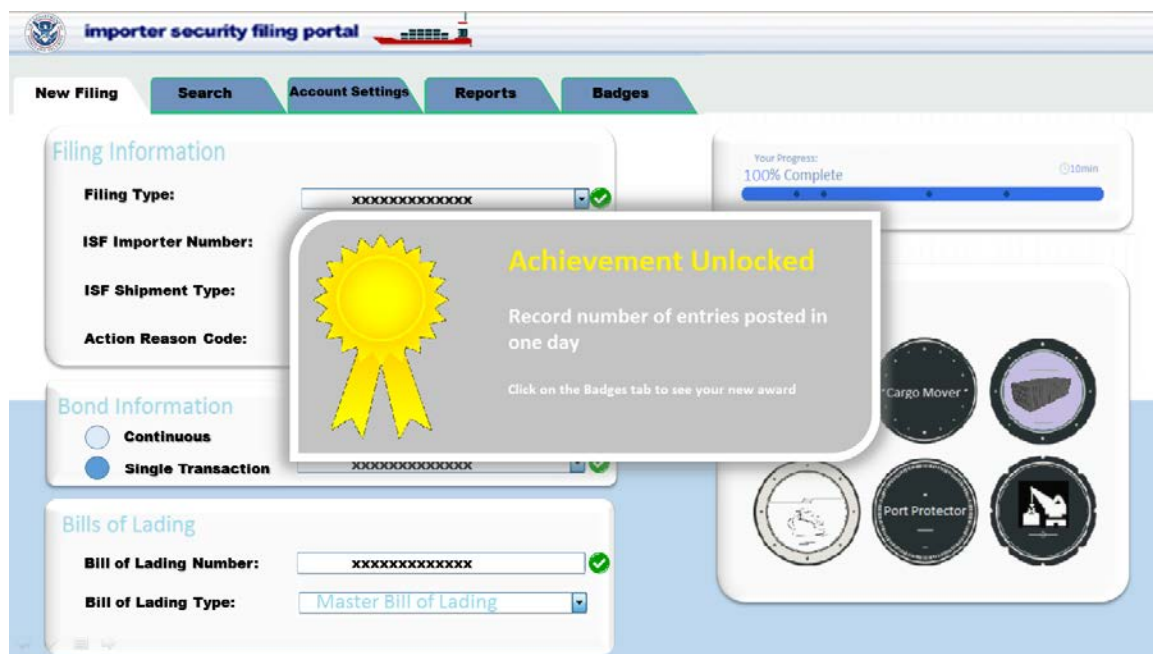


Figure 6. Feedback Mechanisms within the Proposed Importer Security Filing Portal

The general use of the updated ISF portal would likely feature standard gamification items. Simpler items, such as badges, as seen in a number of popular gaming applications, have been shown to increase short-term satisfaction with a system. Badges are tokens that acknowledge an achievement. Earning them gives a player or user

¹⁴⁴ Chou, *Actionable Gamification: Beyond Points, Badges, and Leaderboards*, loc 1375.

a chance to feel victorious or accomplished. Moreover, they can instill the user with “bragging rights,” allowing users to show off their accomplishments to others or to keep track of what they have accomplished.¹⁴⁵ Badges are also useful for spurring motivation in a person by creating a drive to complete a set or collection. Such qualities would make their use within a government data collection system beneficial.

Progress bars, proven to stimulate productivity, could also be implemented. As noted by Yu-kai Chou, progress bars build a “win-state” for users and allow them to see their advancement and motivates them to move closer and closer to their goal.¹⁴⁶ The addition of dynamic and friendly drop down screens and interactive elements would also help to make a system feel more engaging. Finally, light and simple color schemes help a system to appeal to a broader audience and feel more welcoming. These implicit gamification schemes are generally seen as easier to implement and appropriate in most contexts.¹⁴⁷

¹⁴⁵ Zichermann and Linder, *The Gamification Revolution: How Leaders Leverage Game Mechanics to Crush the Competition*, 454.

¹⁴⁶ Yu-kai Chou, *Actionable Gamification: Beyond Points, Badges, and Leaderboards* (San Francisco: Octalysis Group, 2016), loc 710, Kindle edition.

¹⁴⁷ Ibid.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS RELEVANT TO IMPLEMENTATION

Supply chain security has emerged as a new imperative. As a result, CBP enacted a broad range of initiatives that combine to form the foundation of CBP's layered enforcement strategy and were created to ensure the security of maritime supply chains. One such strategy, the Importer Security Filing program enacted in 2009, involves the electronic reporting of cargo prior to departure from the foreign port that allows risk analysis to be conducted prior to the freight's arrival into the United States.

Current CBP data collection systems have flaws in their methodology. They allow users to leave data elements blank, or to use "filler" data points to satisfy immediate requirements (with the intention of later updates to correct data elements). Neither of these flaws benefits CBP significantly in its container review and targeting protocols during a vessel's transit toward the United States. Additionally, users can find these systems burdensome and tedious.

The failure of existing financial penalty policies point to the need for more positive encouragement methods when dealing with outside entities. Financial penalties should still be left in place to punish those who do not comply; however, by utilizing a more enticing method at the front end of the process, CBP can reduce the level of non-compliance with ISF regulations. Preferred designs for operation processes of the gamified systems are not identified, but this method incorporates a better incentive for participation (more "carrot") while still allowing for the existing penalty method ("stick"). The method should also be limited in cost, since a new system does not need to be developed; merely updates are needed to existing systems to incorporate design elements presently used in private sector web platforms.

B. RECOMMENDATIONS

Game aspects have been studied and their incorporation has been shown to shape user behavior toward action anticipated by the system designer.¹⁴⁸ Analysis of the psychological principles associated with gaming strongly suggests their utility toward improving user engagement and activity. As such, the use of gamified techniques within the e-government sphere represents an opportunity to enhance the partnership between private and public arenas toward national security concerns.

Several vendors now offer gamification as a service layer to computer-based systems. These vendors incorporate reward systems with points, badges, levels, or reputation enhancers, such as leader boards, which are designed for the purpose of increasing user engagement.¹⁴⁹ It is therefore recommended that CBP works with vendors to add these features within data collection systems provided to the trade by CBP.

Since the inherent question of this thesis presupposes that the motivation of individuals, or its lack thereof, is a cause of the failure to provide necessary data, it may not serve to solve all the problems associated with this issue. To confirm this premise, an evaluation or poll needs to be conducted amongst trade community employees outside of the scope of CBP in which users must admit freely that they are the cause of the problem. Since such a response is unlikely to occur, it is recommended that CBP conduct a pilot program utilizing lessons learned regarding the gamification techniques and psychological principles herein, and apply these principles toward a smaller CBP system utilized for data collection purposes. A comparison of compliance prior to the implementation of the pilot program and following its implementation would allow for an analysis of the success rates of using such a technique.

The following policy recommendations allow for the most streamlined approach toward the implementation of game-based concepts toward CBP's maritime border

¹⁴⁸ Deterding et al., "Gamification. Using Game-design Elements in Non-gaming Contexts," in *CHI'11 Extended Abstracts on Human Factors in Computing Systems*, 2425–2428.

¹⁴⁹ Ibid.

security data collection needs. They are concentrated on the specific needs and requirements of the Importer Security Filing program. These recommendations are based on the major findings and conclusions referenced within this chapter, as well as the information and analysis throughout this thesis.

1. Launch a Proof of Concept Pilot Project within the ISF Portal Program Using Gamification Strategies

It is recommended that CBP initiate a pilot project to assess the value of gamification toward existing government systems. Since its users represent both a minority share of importers and those less likely to be included among CBP's trusted partner programs, the pilot program should be implemented within the ISF Portal system. Implementation within this system is also recommended because immediate oversight and control is held by CBP. The incorporation of gamification methodology, specifically, those both skillful and exciting, creates intrinsic motivations within system users, which encourages participation and creates a feeling of flow.

Additional areas of application within complimentary CBP systems should also be explored. For example, the use of gamification mechanisms within agency sponsored ISF training websites to educate system users on the features included within the updated portal, as is done in private sector training environments. Gamification strategies may also be used to teach the national security value of the information provided by participants, resulting in enhanced knowledge or more of a sense of urgency, as has been suggested within other DHS gaming research.

2. Establish a Stakeholder Group Comprised of Game System Programmers and CBP Stakeholders

The use of gamified mechanisms within the ISF Portal system must be properly managed to achieve its goals of creating action and flow among its private industry users. As such, the process should include the use of experts within the industry of game systems, as well as experts from all sides of the import process. It is therefore recommended that CBP initiate the proposed pilot with the input and oversight of a stakeholder group comprised of CBP, trade entities, and web design firms with

experience in gamified structures. Use of game experts helps ensure that added gaming features contain the main elemental structures that create a sense of flow and user engagement through a balance of challenge and skill. The incorporation of trade entities permits their concerns and recommendations to be addressed as well. The collaboration of these groups allows for the identification of updates to the existing ISF Portal frameworks that incorporate the benefits of gamification research while enhancing coproduction.

3. Utilize Results from the Proof of Concept to Inform a Comprehensive Approach for Use with Larger-Scale Importers

As this thesis has been largely built upon the application of psychological theory, the proposed proof of concept represents an opportunity to gather data on the applicability of this approach that should be scrutinized. Analysis should focus on the differences between participation rates prior to the implementation of the proof of concept and following its enactment, the acceptance of the practices among private sector participants, and the applications of lessons learned within the other areas of CBP. If found to be successful, broader application and deployment of this program toward large-scale importers, brokers, and carriers that utilize private software to transmit data rather than the ISF Portal system should be assessed.

C. OPPORTUNITIES FOR FURTHER RESEARCH

1. What Are the Ethical Implications of Data Collection Through Games?

The goal of gamification is to create positive emotions resulting in intrinsic motivations, but ethical concerns with its utilization for broader purposes still exist. As the game designer has influence over the actions of the user, the designer may be seen as manipulative. Gamification as represented in this thesis seeks to use gamification toward good, nudging existing users toward a more refined version of a task that they are already meant to perform. It recognizes that actions taken within a gamified system affect real life outside of that system but the morality of this methodology, particularly because in

this case it would be conducted by a government entity, is still likely to be questioned and may not have a simple answer.

2. What Gamification Opportunities Exist that Could be Employed Concurrently within the Maritime Border Security Environment?

While the primary gamification solution identified within this thesis focuses on improving a minority system focused on data collection and expanding once the concept is proven, a complimentary system may also be employed for the benefit of larger groups. Private sector examples like Leaffully and Microsoft's Ribbon Hero series point to the use of game features to generate training and educational systems. Such systems could be utilized for the benefit of the entire trade community, rather than the limited audience of one system to instruct on how to use the required systems or the value of an individuals' role within the homeland security enterprise. Do other complementary areas exist where gamification strategies can enhance maritime border security strategies?

3. Gamification as Applied to Other Border Enforcement Strategies?

Research related to this thesis concentrated on the application of gamification strategies to maritime security environments. However, information identified during the research process pointed to the possibilities of gamification applications being used in land border environments. Such uses include applications and extensions to the DHS's "See Something, Say Something" public outreach campaign intended for the reporting of observed migrants, and land border monitoring systems. Applications toward immigration processing at airports and at land borders may also be feasible. Gamification has the potential to enhance the efficacy of a number of CBP priorities and a review of its applicability toward the various border environments is warranted.

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LIST OF REFERENCES

- Asquer, Alberto. "Not Just Videogames: Gamification and its Potential Application to Public Services." *Digital Public Administration and E-Government in Developing Nations: Policy and Practice*, April 25, 2014. https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2429345.
- Bertot, John Carlo, Paul T. Jaeger, and Derek Hansen. "The Impact of Polices on Government Social Media Usage: Issues, Challenges, and Recommendations." *Government Information Quarterly* 29, no. 1 (2012): 30–40.
- Blegen, Bryce C. "U.S. Importer Security Filing: Advance Electronic Data under the SAFE Framework Meets the Real World." *World Customs Journal* 3, no. 1 (2009): 71–83.
- Bogost, Ian. "Why Gamification Is Bullshit." In *The Gameful World: Approaches, Issues, Applications*, edited by Steffen P. Walz and Sebastian Deterding. 65–80. Cambridge, MA: MIT Press, 2015.
- Bush, George W. *Homeland Security Presidential Directive 5*. Washington, DC: The White House, 2003.
- . *Homeland Security Presidential Directive 8*. Washington, DC: The White House, 2003.
- Caldwell, Stephen L. *Supply Chain Security—Container Security Programs Have Matured, but Uncertainty Persists over the Future of 100 Percent Scanning*. (GAO-12-422T). Washington, DC: United States Government Printing Office, 2012.
- Chiang, Yu-Tzu, Sunny Lin, Chao-Yang Cheng, and Eric Zhi-Feng Liu. "Exploring Online Game Players' Flow Experiences and Positive Affect." *TOJET: The Turkish Online Journal of Educational Technology* 10, no. 1 (January 2011): 106–114.
- Chou, Yu-kai. *Actionable Gamification: Beyond Points, Badges, and Leaderboards*. San Francisco: Octalysis Group, 2016. Kindle edition.
- Coultas, Bryan T. "Crowdsourcing Intelligence to Combat Terrorism: Harnessing Bottom-up Collection to Prevent Lone-wolf Terror Attacks." Master's thesis, Naval Postgraduate School, 2015.
- Cox, Martin. "CMA CGM BENJAMIN FRANKLIN Gets Hollywood Welcome." *Maritime Matters*, December 27, 2015. <http://maritimematters.com/2015/12/cma-cgm-benjamin-franklin-gets-hollywood-welcome/>.

- Csikszentmihalyi, Mihaly. *Flow: The Psychology of Optimal Experience*. New York: Harper Row, 1990.
- Dahlman, Ola, Jenifer Mackby, Bernard Sitt, Andre Poucet, Arend Meerburg, Bernard Massinon, Edward Ifft, Masahiko Asada, and Ralph Alewine. *Container Security: A Proposal for a Comprehensive Code of Conduct*. Washington, DC: National Defense University, Center for Technology and National Security Policy, 2005.
- Deci, Edward L., and Richard M. Ryan. "Self-determination Theory." *Handbook of Theories of Social Psychology* 1 (2011): 416–433.
- . "Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being." *American Psychologist* 55, no. 1 (2000): 68–77.
- Deterding, Sebastian. "Meaningful Play: Getting Gamification Right." YouTube video. Google Tech Talk presented January 24, 2011. Posted online February 18, 2011. <https://www.youtube.com/watch?v=7ZGCPap7GkY>.
- . "Situated Motivational Affordances of Game Elements: A Conceptual Model." In *Gamification: Using Game Design Elements in Non-gaming Contexts*, CHI 2011 Workshop, Vancouver, BC, May 7–12, 2011.
- Deterding, Sebastian, Miguel Sicart, Lennart Nacke, Kenton O'Hara, and Dan Dixon. "Gamification. Using Game-design Elements in Non-gaming Contexts." In *CHI'11 Extended Abstracts on Human Factors in Computing Systems*. 2425–2428. New York: ACM, 2011.
- Deterding, Sebastian, Rilla Khaled, Lennart Nacke, and Dan Dixon. "Gamification: Toward a Definition." Paper presented at the CHI 2011 Gamification Workshop Proceedings, Vancouver, BC: Canada, May 7–12, 2011. <http://gamification-research.org/wp-content/uploads/2011/04/02-Deterding-Khaled-Nacke-Dixon.pdf>.
- Dignan, Aaron. *Game Frame: Using Games as a Strategy for Success*. New York: Simon and Schuster, 2011.
- Ding, Li, Dominic DiFranzo, Alvaro Graves, James R. Michaelis, Xian Li, Deborah L. McGuinness, and James A. Hendler. "TWC Data-gov Corpus: Incrementally Generating Linked Government Data from data.Gov." In *Proceedings of the 19th International Conference on Worldwide Web*. 1383–1386. New York: ACM, 2010.
- Finneran, Christina, and Ping Zhang. "The Challenges of Studying Flow within a Computer-mediated Environment." *AMCIS 2002 Proceedings* (2002).

- Gordon, Peter, James E. Moore II, Harry W. Richardson, and Qisheng Pan. "Ch. 14. The Economic Impact of a Terrorist Attack on the Twin Ports of Los Angeles-Long Beach." In *The Economic Impacts of Terrorist Attacks*, edited by Harry W. Richardson, Peter Gordon, and James E. Moore II. 262–285. Cheltenham, United Kingdom: Edward Elgar Publishing Ltd., 2007.
- Gorman, Chad. "Getting Serious About Games-Using Video Game-based Learning to Enhance Nuclear Terrorism Preparedness." Master's thesis, Naval Postgraduate School, 2012.
- Hamari, Juho. "Transforming Homo Economicus into Homo Ludens: A Field Experiment on Gamification in a Utilitarian Peer-to-Peer Trading Service." *Electronic Commerce Research and Applications* 12, no. 4 (2013): 236–245.
- Hamari, Juho, Jonna Koivisto, and Harri Sarsa. "Does Gamification Work? A Literature Review of Empirical Studies on Gamification." Paper presented at the 47th Hawaii International Conference on System Sciences, January 6–9, 2014.
- Haveman, Jon D., and Howard J. Shatz. *Protecting the Nation's Seaports: Balancing Security and Cost*. San Francisco: Public Policy Institute of California, 2006. http://www.ppic.org/content/pubs/report/R_606JHR.pdf.
- Herger, Mario. *Enterprise Gamification: Engaging People by Letting Them Have Fun: Book 1-The Basics*. Los Altos, CA: EGC Media, 2014. Kindle edition.
- Jones, Vivian C., and Marc R. Rosenblum. *U.S. Customs and Border Protection: Trade Facilitation, Enforcement, and Security*. (CRS Report No. R43014). Washington, DC: Congressional Research Service, 2013.
- Jung, Jeesang, Joost R. Santos, and Yacov Y. Haimes. "International Trade Inoperability Input-Output Model (IT-IIM): Theory and Application." *Risk Analysis* 29, no. 1 (2009): 137–154.
- Kanat, Irfan E., Sathananda Siloju, T. S. Raghu, and Ajay S. Vinze. "Gamification of Emergency Response Training: A Public Health Example." In *Intelligence and Security Informatics, IEEE International Conference on Intelligence and Security Informatics*. Seattle, WA: IEEE, 2013. <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6578802&isnumber=6578763>.
- Keane, Angela Greiling, and Kyunghee Park. "The Terrorist Threat in Cargo Containers." *Bloomberg BusinessWeek*, November 4, 2010. <https://www.bloomberg.com/news/articles/2010-11-04/the-terrorist-threat-in-cargo-containers>.

- Kerlikowske, Gil. “Commissioner Kerlikowske’s Remarks at the Joint Annual Meeting of the American Iron and Steel Institute (AISI) and the Metals Service Center Institute (MSCI).” May 2, 2016. <https://www.cbp.gov/newsroom/speeches-and-statements/2016-05-02-000000/commissioner-kerlikowske’s-remarks-joint-annual>.
- Kim, Sangkyun. “Fundamental Strategic Approach for Gamification: How to Start a Gamification in Your Organization.” *International Journal of Digital Content Technology and its Applications*, August 2013.
- Leonard, Timothy J., Philip Gallo, and Simon Véronneau. “Security Challenges in United States Sea Ports: An Overview.” *Journal of Transportation Security* 8, no. 1–2 (2015): 41–49. <https://nps.illiad.oclc.org/illiad/illiad.dll?Action=10&Form=75&Value=150548>.
- Levinson, Marc. *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*. Princeton, NJ: Princeton University Press, 2006.
- Linders, Dennis. “We-Government: An Anatomy of Citizen Coproduction in the Information Age.” In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times*. 167–176. New York: ACM, 2011.
- Longeray, Pierre. “The French Government Has an App to Warn People about Terror Attacks and Nuclear Disasters.” *VICE News*, June 10, 2016. <https://news.vice.com/article/the-french-government-has-launched-an-app-to-warn-people-about-terror-attacks-and-nuclear-disasters>.
- McGonigal, Jane. “How to Re-Invent Reality without Gamification.” Lecture, Serious Games Summit, 2011. <http://www.gdcvault.com/play/1014576/We-Don-t-Need-No>.
- Meade, Charles, and Roger C. Molander. *Considering the Effects of a Catastrophic Terrorist Attack*. Santa Monica, CA: RAND, 2006. http://www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR391.pdf.
- Microsoft. “Ribbon Hero 2.” 2011. <https://www.microsoft.com/en-us/download/details.aspx?id=26531>.
- Mittal, Sheta. “Run With Data On Nike+.” Harvard Business School, 2015. <https://openforum.hbs.org/challenge/understand-digital-transformation-of-business/data/run-with-data-on-nike>.
- Monahan, Colleen, Lars Ullberg, and Kevin Harvey. “Virtual Emergency Preparedness Planning Using Second Life.” In *Service Operations, Logistics and Informatics, 2009. SOLI'09*. IEEE/INFORMS International Conference on Service Operations, Logistics and Informatics. Chicago: IEEE/INFORMS, 2009.

- National Archives and Records Administration. *Part II, Department of Homeland Security, U.S. Customs and Border Protection, 19 CFR Parts 4, 12, 18, et al. Importer Security Filing and Additional Carrier Requirements; Final Rule, Federal Register, vol. 73, no. 228*. College Park, MD: National Archives and Record Administration, 2008. <https://www.gpo.gov/fdsys/pkg/FR-2008-11-25/pdf/E8-27048.pdf>.
- Nepal, Surya, Cecile Paris, and Sanat Bista. "Gamification on the Social Web." In *Social Media for Government Services*, edited by Surya Nepal, Cécile Paris, and Dimitrios Georgakopoulos. 97–220. Cham, Switzerland: Springer International Publishing, 2015.
- Nike. "Nike+ Run Club App." Accessed February 27, 2017. http://www.nike.com/us/en_us/c/nike-plus/running-app-gps?cp=usns_kw_nike_null_txt!g!c!br!e!nike%20plus&k_clickid=3420ad76-e68c-4074-84d5-7c2b89d8006a.
- Novak, Thomas, and Hoffman, Donna. "Measuring the Flow Experience among Web Users." Paper presented at Interval Research Corporation, July 31, 1997.
- Olson, Nate, Brian Finlay, and Esha Mufti. *A Go-to-Market Strategy: Promoting Private Sector Solutions to the Threat of Proliferation*. Washington, DC: Henry L. Stimson Center, 2013.
- Pahlka, Jennifer. "Coding a Better Government." TED, February 1, 2012. https://www.ted.com/talks/jennifer_pahlka_coding_a_better_government#t-136896.
- Park, Ji Young. "The Economic Impacts of Dirty Bomb Attacks on the Los Angeles and Long Beach Ports: Applying the Supply-driven NIEMO (National Interstate Economic Model)." *Journal of Homeland Security and Emergency Management* 5, no. 1 (2008).
- Parks, Roger B., Paula C. Baker, Larry Kiser, Ronald J. Oakerson, Elinor Ostrom, Vincent Ostrom, Stephen L. Percy, Martha B. Vandivort, Gordon P. Whitaker, and Rick Wilson. "Consumers as Co-producers of Public Services: Some Economic and Institutional Considerations." *Policy Studies Journal* 9, no. 7 (1981): 1001–1011.
- Pellegrini, Tassilo. "A Theory of Co-Production for User Generated Content—Integrating the User into the Content Value Chain." econstor, 2007.
- Petersen, Ryan. "Customs Compliance: Importer Security Filing." Flexport, 2014. <https://www.flexport.com/learn/customs-compliance-importer-security-filing/>.
- Pink, Daniel H. *Drive: The Surprising Truth about What Motivates Us*. London: Penguin, 2011.

- Porter, David O. "Co-Production and Network Structures in Public Education." In *New Public Governance, the Third Sector, and Co-Production*, edited by Victor Pestoff, Taco Brandsen, and Brad Verschuere. 145–168. New York: Routledge, 2012.
- Power, Robert, Bella Robinson, and Catherine Wise. "Using Crowd Sourced Content to Help Manage Emergency Events." In *Social Media for Government Services*, edited by Surya Nepal, Cécile Paris, and Dimitrios Georgakopoulos. 247–270. Cham, Switzerland: Springer International Publishing, 2015.
- Queensland Government. *Budget Paper, Queensland's Natural Disasters 2013–14*. Queensland, Australia: Queensland Government, 2013. <http://www.parliament.qld.gov.au/Documents/TableOffice/TabledPapers/2013/5413T2788.pdf>.
- Rao, Shashank, and Thomas J. Goldsby. "Supply Chain Risks: A Review and Typology." *The International Journal of Logistics Management* 20, no. 1 (2009): 97–123.
- Reeve, John Marshall, Glen Nix, and Diane Hamm. "Testing Models of the Experience of Self-Determination in Intrinsic Motivation and the Conundrum of Choice." *Journal of Educational Psychology* 95, no. 2 (2003): 375–392.
- Reynolds, Brian, quoted in Yongwen Xu. *Literature Review on Web Application Gamification and Analytics*. Honolulu: University of Hawaii, 2011. http://www.quilageo.com/wp-content/uploads/2013/07/Gamification_11-051.pdf.
- Richardson, Michael. "Growing Vulnerability of Seaports from Terror Attacks." YaleGlobal Online, March 4, 2014. <http://yaleglobal.yale.edu/content/growing-vulnerability-seaports-terror-attacks>.
- Richter, Ganit, Daphne R. Raban, and Sheizaf Rafaeli. "Studying Gamification: The Effect of Rewards and Incentives on Motivation." In *Gamification in Education and Business*, edited by Torsten Reiners and Lincoln C. Wood. 21–46. Cham, Switzerland: Springer International Publishing, 2015.
- Ritter, Luke J., Michael Barrett, and Rosalyn A. Wilson. *Securing Global Transportation Networks: A Total Security Management Approach*. New York: McGraw-Hill, 2007.
- Robertson, Margaret. "Cant Play, Wont Play." HideandSeek.net, November 10, 2010. <http://hideandseek.net/2010/10/06/cant-play-wont-play/>.
- Rockwell, Geoffrey M., and Kevin Kee. "The Leisure of Serious Games: A Dialogue." *Game Studies* 11, no. 2 (May 2011). http://www.gamestudies.org/1102/articles/geoffrey_rockwell_kevin_kee.
- Rogers, Everett M. *Diffusion of Innovations*, 5th ed. New York: Free Press, 2003.

- Rosoff, Heather, and Detlof Von Winterfeldt. "A Risk and Economic Analysis of Dirty Bomb Attacks on the Ports of Los Angeles and Long Beach." *Risk Analysis* 27, no. 3 (2007): 533–546.
- Ryan, Richard M., and Edward L. Deci. "Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-being." *American Psychologist* 55, no. 1 (2000): 68–78.
- Schollmeyer, Josh. "Games Get Serious." *Bulletin of the Atomic Scientists* 62, no. 4 (2006): 34–39.
- Shiau, Wen-Lung, Li-Chun Huang, and Chia-Hui Shih. "Understanding Continuance Intention of Blog Users: A Perspective of Flow and Expectation Confirmation Theory." *Journal of Convergence Information Technology* 6, no. 4 (2011): 306–317.
- Shirky, Clay. *Cognitive Surplus: Creativity and Generosity in a Connected Age*. East Rutherford, NJ: Penguin Press, 2012.
- Toor, Amar. "France Launches Terror Alert App Ahead of Euro 2016 Tournament." *The Verge*, June 8, 2016. <https://www.theverge.com/2016/6/8/11881732/france-terrorism-alert-euro-2016-app>.
- U.S. Customs and Border Protection. *Benefits of ACE for Importers Fact Sheet*. Washington, DC: Department of Homeland Security, 2012. https://www.cbp.gov/sites/default/files/documents/overview_importers_fact_sheet_2.pdf.
- . "CBP Enters Next Phase of Importer Security Filing." June 7, 2013. <https://www.cbp.gov/newsroom/national-media-release/cbp-enters-next-phase-importer-security-filing>.
- . *Container Security Initiative in Summary*. Washington, DC: Department of Homeland Security, 2011. https://www.cbp.gov/sites/default/files/documents/csi_brochure_2011_3.pdf.
- . "Do I Need a License to Import Something." Accessed March 3, 2017. https://help.cbp.gov/app/answers/detail/a_id/197/noIntercept/1.
- . "Importer Security Filing '10+2.'" July 5, 2017. <https://www.cbp.gov/border-security/ports-entry/cargo-security/importer-security-filing-102>.
- . *Importer Security Filing (ISF) Enforcement Update Webinar—Transcript*. Washington, DC: Department of Homeland Security, 2016. https://www.cbp.gov/sites/default/files/documents/ISF%20Webinar_Transcript_0.pdf.
- . "Trade." Accessed May 29, 2016. <https://www.cbp.gov/trade>.

- U.S. Department of Homeland Security. *Department of Homeland Security Office of the CIO E-Government Act Report of 2008*. Washington, DC: U.S. Department of Homeland Security, 2008. https://www.dhs.gov/sites/default/files/publications/cio_egov_annual_report_2008_0.pdf.
- U.S. Department of Transportation, Bureau of Transportation Statistics. “Maritime Trade and Transportation by the Numbers.” Washington, DC: U.S. Department of Transportation, 2012. https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/by_the_numbers/maritime_trade_and_transportation/index.html.
- Van de Voort, Maarten, Henry H. Willis, David S. Ortiz, and Susan E. Martonosi. “Applying Risk Assessment to Secure the Containerized Supply Chain.” In *Managing Critical Infrastructure Risks*, edited by Igor Linkov, Richard J. Wenning, and Gregory A. Kiker. 79–95. Netherlands: Springer, 2007.
- Vesky, Jonathon P. ed. *Port and Maritime Security*. Hauppauge, NY: Nova Publishers, 2008.
- Walz, Steffen P., and Sebastian Deterding. *The Gameful World: Approaches, Issues, Applications*. Cambridge, MA: MIT Press, 2014.
- Wood, Colin. “Gamification: Governments Use Gaming Principles to Get Citizens Involved.” *Government Technology*, 2013. <http://www.govtech.com/local/Gamification-Governments-Use-Gaming-Principles-to-Get-Citizens-Involved.html>.
- Wrightson, Margaret T. *Maritime Security: Enhancements Made, But Implementation and Sustainability Remain Key Challenges, Testimony before the Committee on Commerce, Science, and Transportation, U.S. Senate*. (GAO-05-448T). Washington, DC: Government Accountability Office, 2005.
- Xu, Yongwen. *Literature Review on Web Application Gamification and Analytics*. Honolulu: University of Hawaii, 2011. http://www.quilageo.com/wp-content/uploads/2013/07/Gamification_11-051.pdf.
- Zichermann, Gabe, and Joselin Linder. *The Gamification Revolution: How Leaders Leverage Game Mechanics to Crush the Competition*. New York: McGraw Hill Professional, 2013. Kindle edition.

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